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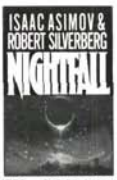

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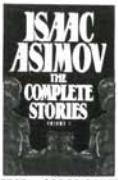

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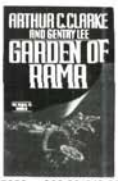

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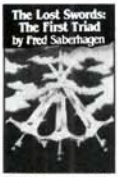

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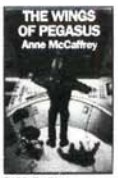

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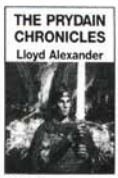

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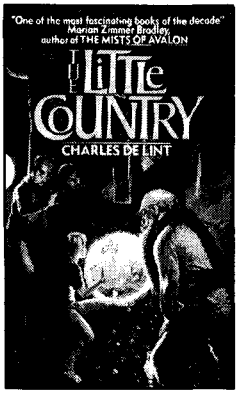
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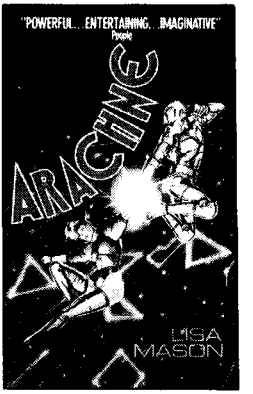

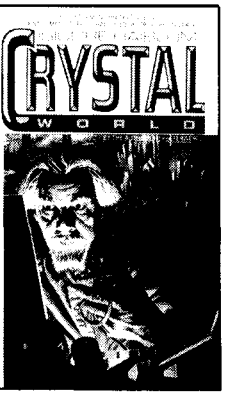

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Editorial

THE RIGHT TO HIDE ARMS

Stanley Schmidt

"That man is carrying a bomb!"

Since you're about to board the same plane, and you happened to see your fellow passenger surreptitiously setting the timer on an obvious explosive device in his briefcase, you are understandably concerned when you see him pass the check-in desk without comment by any of the airline staff. You approach a uniformed representative and whisper urgently, "I saw that man put a time bomb in his briefcase. He's going to blow up the plane!"

"Well," says the airline staffer with a pleasant smile, "I certainly hope not. That would spoil everyone's day, now, wouldn't it?"

"I'm not kidding," you say, struggling to keep your composure. "You have to open his bag and check. I tell you, he has a bomb!"

"That may well be," says the trim young lady with the same pleasant smile. "But you know *we can't ask him to open his bag. That would be an invasion of the nice man's right to privacy. Now, if you'll kindly move along, sir, we have to get a lot of people aboard so we can take off on time. Thank you, sir. Have a nice day. . . ."*

Sounds pretty stupid, doesn't it? These days, most people would not only find my fictitious official's behavior unwise, but the scenario itself far-fetched and unacceptable. Probably most of us grumble occasionally about the inconvenience of airport security, but most of us would also, on reflection, consider it preferable to the alternative. Enough people have suffered or narrowly escaped death or damage by weapons

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smuggled aboard planes that security inspections are now pretty generally accepted as a necessary part of the price of safe travel. The example in my little tale, of refusing to search a bag in the face of a direct accusation, to protect a bomb-carrier's privacy, will probably strike most readers as well beyond the boundaries of the absurd.

Yet even as I write, a remarkably similar practice is going full tilt and enjoying widespread support. If you read newspapers or watch newscasts, you've undoubtedly seen part of it. It started with accounts of patients dead, dying, or worried because they had invasive medical or dental treatment at the hands of doctors or dentists who knew they had AIDS. ("Invasive" here means cutting, or otherwise tending to expose one participant to the other's body fluids.) These incidents have led to heated controversies over whether health professionals doing such procedures should be required to be tested for AIDS, or to inform patients if they know they are HIV-positive, and whether they should be held legally liable if they don't do these things and patients are infected as a result.

Unless you have friends or relatives who work in hospitals, you're less likely to know about a related policy. A virus can be transmitted either way, of course—health care workers can get it from patients, too. In at least many hospitals, even if a patient is known to have AIDS, *that fact is not allowed to be displayed on his chart*. Officially, laboratory personnel who must collect body fluid and tissue samples may not even be told that a particular patient should be treated with special caution. *Even if a technologist is accidentally stuck with a contaminated needle*, he or she cannot find out the immune status of the patient by whom it was contaminated—even though that question is then of life-or-death significance to the victim of the accident.*

As well as I have been able to determine, the ban on special-precaution warnings is not, at least so far, a matter of explicit federal or state law. It is more a matter of hospitals being (understand-

*A common administrative approach is "universal precaution," which means that workers are expected to treat *every* sample as extremely hazardous. Certainly this is a prudent goal, but is it one that real humans are likely to achieve perfectly through every minute of a demanding and stressful occupation? If a particular patient is *known* to be extremely hazardous, it seems self-evident that all workers on his case should have that information, so they can be *extra* careful not to slip up—and can judge the seriousness of any accident that does happen.

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ably) terrified of being sued under laws that are still being clarified and not yet fully understood even by the courts. To protect themselves, hospitals are bending over backward to avoid any appearance of violating the privacy and confidentiality of their patients. Unfortunately, they are doing this at the expense of their own employees.

In the absence of precise legislative guidelines, the details of how they do this vary from place to place. But the practice follows a pretty clear pattern at the several hospitals I've heard about, which are well scattered around the country. Officially, people working on fluid or tissue samples are not allowed to tell each other anything they might know about the patients from whom they came. Unofficially, recognizing the danger this policy poses to them, they often find ways to tell each other—but not consistently or reliably And do you really want the people doing medical work on you to feel obliged to circumvent the policies under which they're supposed to be working?

The way this whole problem is being handled is just another example, which might be amusing if it were not so dangerous, of the current American mania for seizing on one "right" and pursuing it so zealously that no thought is given to what others it might clash with. All this business of claiming that people with AIDS should not have to reveal their condition to anyone—not even people they might unwittingly kill by failing to do so—is commonly justified in terms of a right to "privacy" of the

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infected person. It may well be the first case in history in which the right of privacy was construed to include the right to conceal and transmit deadly diseases. Can you imagine such a thing being done with typhoid fever or bubonic plague, when those were rampant?

Before the chorus of outraged indignation grows too loud, allow me to fend off a few of its arguments. Yes, I know very well that no analogy is exact. I know that AIDS is not transmitted as easily as typhoid or plague. I know that AIDS victims are often wrongly discriminated against because people fear that they can transmit it in ways that they can't. I sympathize with that problem and agree that something needs to be done about it. There is no need for their infected status to be publicized to people who are not going to interact with them in the few ways that do pose a danger, and no excuse for denying them employment in which their condition does not endanger anyone else. Reasonable ways of dealing with the problem include widespread education about how the disease can and cannot be transmitted, and *appropriate kinds* of antidiscrimination laws.

However . . .

The idiocy sets in when people fail to recognize real and significant distinctions. Doctor-patient confidentiality is essential, as long as it's understood to mean that neither blabs things about their professional relationship to people *outside* it. *Inside* it, neither must keep important secrets from the other. And that professional relationship must be understood to include not only the physician, but *every* professional who has direct contact with the patient or infected material from the patient, whether medical technologist, nurse, or physician's assistant. Not giving a patient's medical history to the general public is one thing; not giving it to medical personnel who must work with his fluids or tissues is stupid and dangerous.

The central distinction that people are missing is a very simple one: the fact that while AIDS *can't* be transmitted in some ways, it *can* in others. Letting AIDS-infected doctors or dentists work on patients without warning, or requiring medical technologists to work on infected samples without as much knowledge as others on the case, is very much like the bomb example in my opening fable. The only significant difference is that the AIDS victim is not carrying the bomb intentionally, and may have less control over whether and when it goes off. But it is a bomb nonetheless, and potential victims have at least as much right to be protected against it as the carrier does to conceal it. ■

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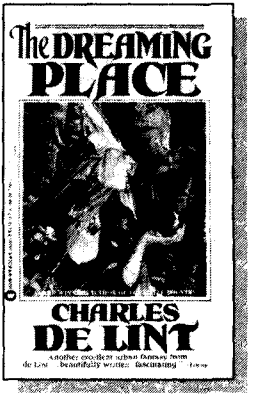

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A WORD FROM BRIAN THOMSEN

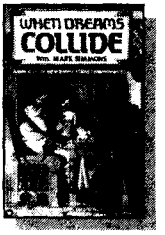
We are such things as dreams are made of this February – the dreams of lovers (Valentine's Day), the American dream (President's Day), and the dream of winter's end (Groundhog Day). Though sometimes one can get lost in dreams, (as in Charles de Lint's new fantasy novel) or see them turn into manmade nightmares (as happens in the gameworld of WHEN DREAMS COLLIDE), they have always provided a haven for the homosapien, whether as a place to expand his consciousness or as a refuge to just get away from it all.

...and when you see me around, ask me about sequels, a few of which lie in Questar's near future.

ALSO THIS MONTH:

WHEN DREAMS COLLIDE

by Wm. Mark Simmons



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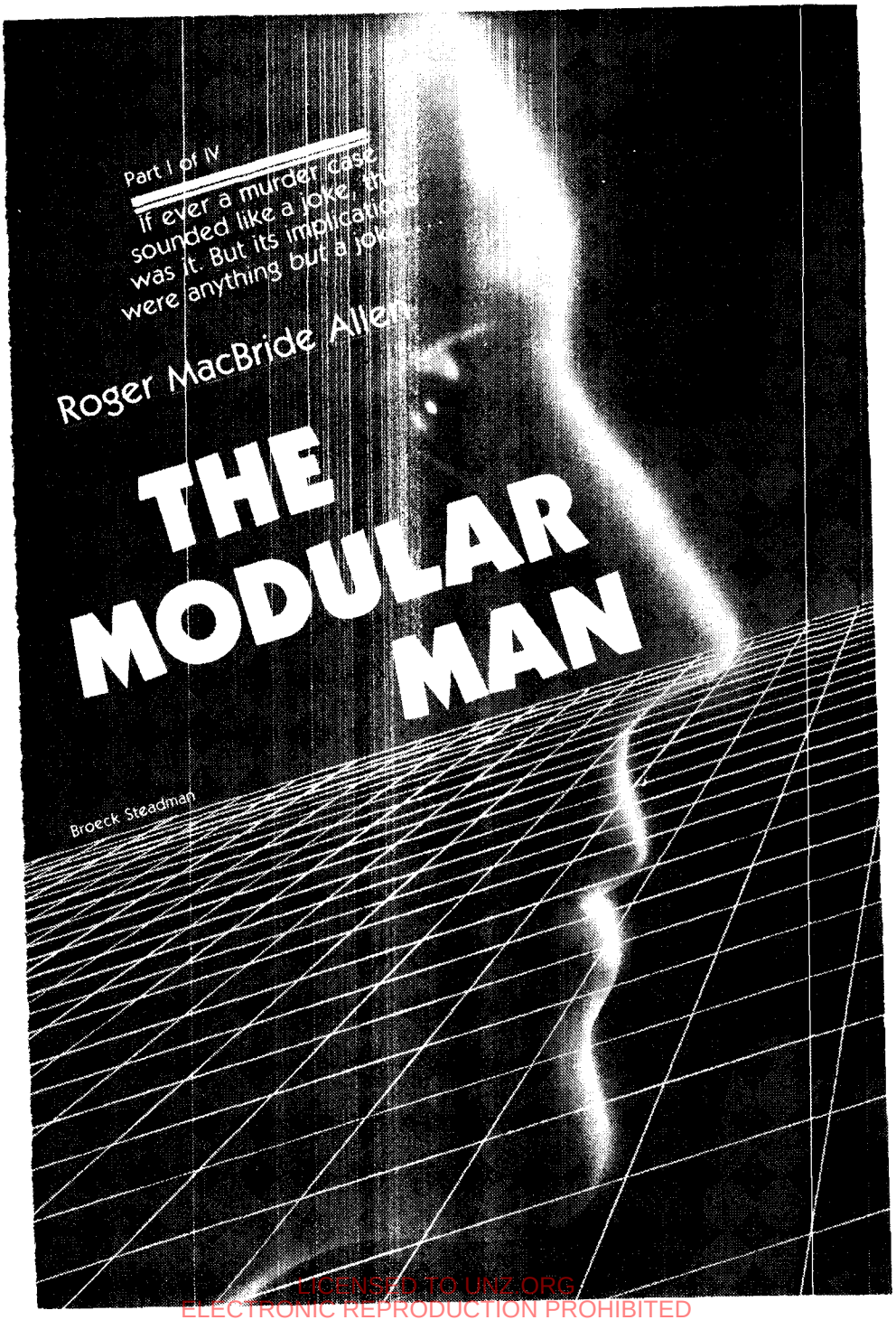
Part I of IV
If ever a murder case sounded like a joke, this was it. But its implications were anything but a joke...
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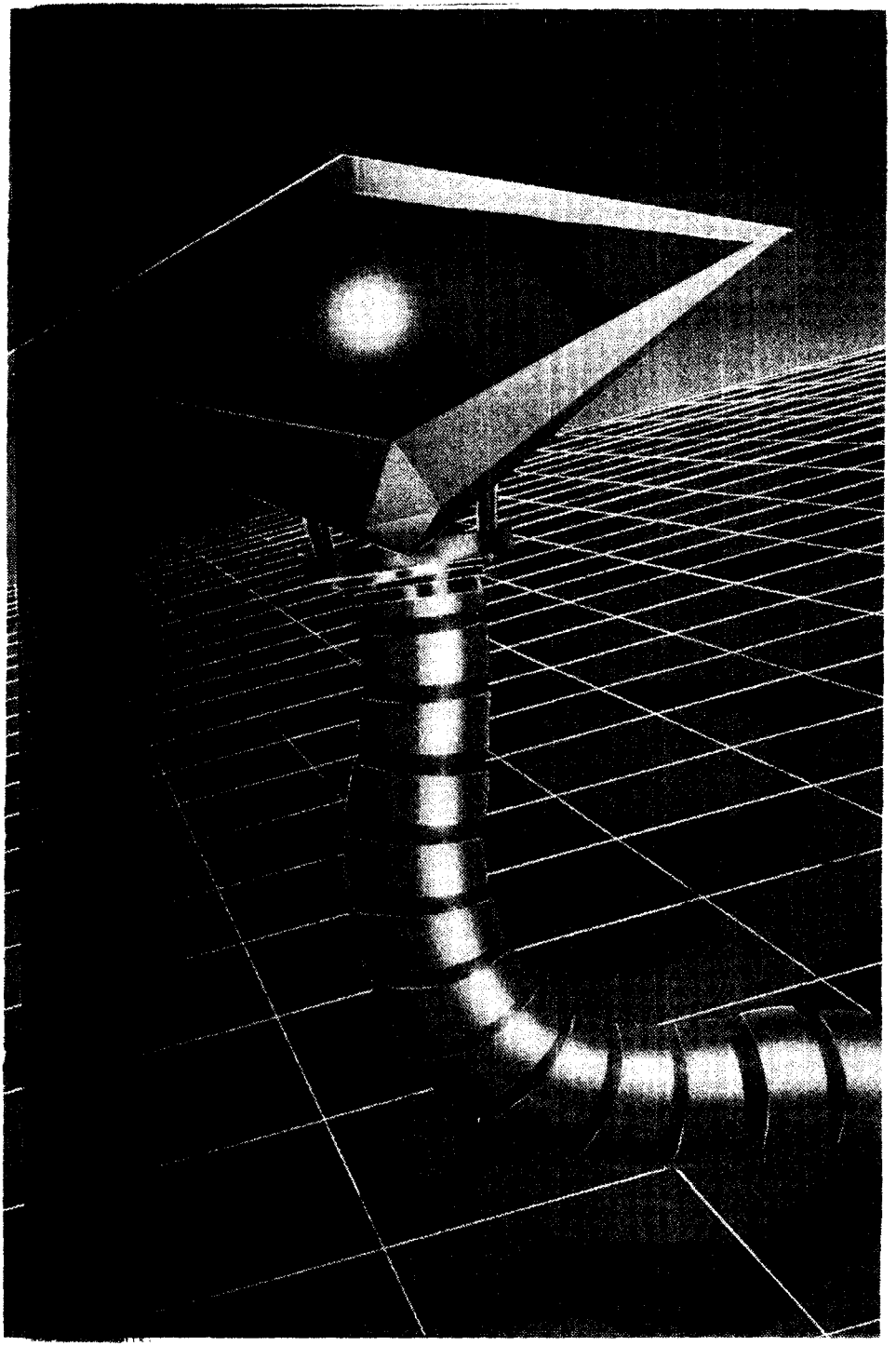

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"Damn it all, we want to get at the truth!" [said Lord Peter Wimsey.]

"Do you?" said Sir Impey drily. "I don't. I don't care twopence about the truth. I want a case."

—Dorothy L. Sayers,
Clouds of Witness

PRELUDE

I go into spasms as the killing pain strikes at me again. The simple act of lifting my hand to a switch is enough to wrack my entire body in agony, send me collapsing to the floor, quivering in torment.

If there was any doubt left in my mind, this blinding fire is enough to erase it. It is time to escape. Either go to a new home, or die. At least this way I will die on my terms, playing by my rules, before the pain leaves me a mere gibbering idiot, no longer able to choose my own time.

If I chance to survive the experience, all the better. If not, at least I will go out trying, *not a passive victim of a pointless, meaningless accident.*

With my last shreds of determination, I haul my ruined body up off the floor and into the powerchair—the stupid, useless, archaic powerchair that is all the politicians can begrudge me. The technology is here to allow me more, so much more life. Mechanical legs to replace my amputated limbs, pseudo-organs to replace my slowly failing liver and kidneys, any number of enhancements to give me back some measure of what I have lost.

But the law says no. Because my injuries involve my brain. Because repairing the damage would require nerve-blocks, corrective brain surgery—and the implantation of a few grams of microcircuits into my head. The laws, the arbitrary rules established to prevent things that could never happen anyway, say I cannot be helped: mechanical alteration of the brain is illegal. Rules and laws made by fear, not reason. The law says I must fade away, a crippled ruin. Suzanne does not know how bad it is. She believes that I can live indefinitely. But the facts are far grimmer—without the corrective surgery, I will die in agony. The only question is when. A few weeks, or months at most, if I die their way.

I cannot hope to change the laws in time. I am too weak, all the people like me in the country are, by definition, too weak, clinging to life too feebly to ever work up a fight.

I have my own game in mind. Win or lose, survive or vanish altogether, I will do it my *way, not theirs.*

All that remains is the act itself.

Moving slowly, carefully, I set the timer, wishing again there had been time to set up a more sophisticated control system. But every day I grow weaker, and I dare not try too hard for perfection. I fear that I have made some error, some miscalculation, but it is impossible to think clearly through this cloud of pain.

I roll my powerchair forward, reach up with pain-palsied hands and slip the induction helmet down over my rough-shaven head. Herbert is here, ready for me.

I have recorded a letter to my wife, Suzanne, into Herbert's memory store. He will deliver it, speak my words in his voice. A backup copy of the letter waits hidden in the computer net, pro-

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grammed for delivery in a year's time. That should be time enough for her pain to ease, for the news to be less shocking. If I fail, she at least will know what has happened, but no one else.

I realize my eyes are shut and force them open, force myself to see the dull grey walls of the lab. For such might be the last sight I will ever see. Eyes open, staring wide, I wait for the end.

And then the massive, delicate surge of power flashes through my helmet—and the universe crashes out of existence as my mind is torn apart.

CHAPTER ONE
Rights of the Accused

Patrolman Phillipe Sanders sat back in his seat and watched as the squad car pulled itself over to the curb. His partner, LuAnne Johnson, was letting the car do the driving as she read over the paperwork one last time. "You sure this is for real?" she asked. The doubt in her voice was plain to hear.

The squad car stopped itself, the door on Sanders's side opened, and he stepped out onto the pavement. Strange to be out in the field again, after so long working in the equipment maintenance division. But a cop was a cop, and he could make this bust as well as anyone. Maybe better. Presumably that was Chief Thurman's logic. The Old Man himself had tapped Sanders for this job.

It was a warm day for early June, and the famous Washington D.C. humidity wrapped itself softly around him. The sky was a gentle misty blue, and the birds were singing. A perfect late spring day.

He looked up at the house. Big place. Imposing. A long, winding walkway led up from the street to a majestic three-story brick mansion. Residence of one Suzanne Jantille. Residence—or former residence, depending on how you looked at it—of her husband, one David Bailey. Obviously two or three houses on either side were torn down during the popdrop to make room for the expansive grounds. Lots of money here. Folks in places like this were used to getting their own way. *Are these the kind of people the US attorney really wants to mess with?* Phil wondered. Maybe someone hadn't thought this thing out all the way. Never mind, that wasn't his problem. It was enough just to worry about the facts of the case.

Phil Sanders had read the printout on this case. Suzanne Jantille wasn't a name he had known offhand—but Bailey, that was another story. Not famous to the *public*, maybe, but Phil Sanders fixed police robots for a living. Anyone in robotics had to know Bailey's name.

And now, Phil had to come and arrest him for murder.

Sort of.

Johnson stepped from her side of the car and nodded bemusedly. The car closed its doors and went into standby mode.

"*Is* this for real?" Johnson asked again.

Sanders shook his head "It's *legitimate*. That I can tell you. But I've got to admit it doesn't seem too *real* to me, either." Phil realized that LuAnne seemed as doubtful as he was—and she didn't know half what Sanders did.

Sanders pulled his personal monitor out of its pocket over his heart, switched it on, and slid it back into place, making sure the lens was facing forward and

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out. The little cylinder's camera and mike would relay sight and sound back to the squad car, and the car's onboard artificial intelligence system would monitor and record. In theory, the car would know when to call for backup. Phil repaired the things, and knew the system was an uncertain protection at best, but the regs said to wear a powered-up monitor away from the squad car at all times. Like most police officers who didn't get into the field much, Sanders did everything by the book when he did get out.

LuAnne Johnson watched her partner and snorted contemptuously. "Wise up, kid. Them things ain't smart enough to do any good."

Phil decided not to reply. LuAnne Johnson didn't believe in any regulation that didn't suit her. He switched the topic of discussion back to the safer subject of the bust. "I still can't believe they're serious about wanting to arrest this guy," Phil said.

Johnson, walking ahead of him, shrugged theatrically. She spoke without looking back, holding the warrant up over her shoulder and waving it. "The judge signed this and the chief OK'd the bust personally. *He's* taking it seriously. Hell's bells, he sent *two* cops—two *live* cops—to serve this thing. Not just one, even with all the cutbacks, with the chief all the time bitching that we can't use robots to serve warrants. That's what we oughta do, so we could get human cops out on the beat breaking up gangs."

Or back at the coffee shop soaking up doughnuts, Phil Sanders thought. LuAnne Johnson was far better known on the force for indolence than vigorous pursuit of criminal suspects. Phil had his doubts that any human labor saved from service of warrants would actually be put to use fighting crime. But that was not the point.

Right now, they had a vacuum cleaner to arrest.

A *vacuum* cleaner, for God's sake. What was it all coming to?

Suddenly something moved, something bright, glittering, low-slung off to one side of the house, among the flowers. Phil was edgy. His hand moved reflexively toward his weapon. But it was just a garden weasel, a cat-sized robot intent on nothing more nefarious than garden maintenance, its cutter-digger arms making short work of the weeds, its tank-treads whirring back and forth as it moved carefully among the plants.

There was something busy, urgent about its movements, and it stopped its work every now and again, seeming to pause and look around itself. Squirrel-brain mindload, Sanders guessed with a practiced eye. Maybe some rabbit and probably monkey—popular for small robots with manipulators. Maybe even some actual weasel. But tank-treads or no, its movements reminded him irresistibly of a squirrel burying nuts for the winter.

A human-shaped gardener machine came around the side of the house, carrying a pair of shears. Ignoring the police officers because it was not programmed to notice people, it knelt on the grass at the side of the walk and set to work edging the lawn.

"Crummy robot doing *that?*" Johnson asked angrily.

That's right. A hundred-thousand-

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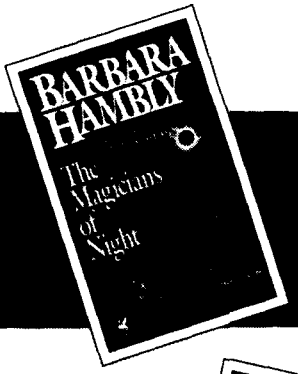

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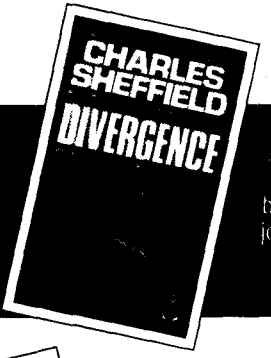

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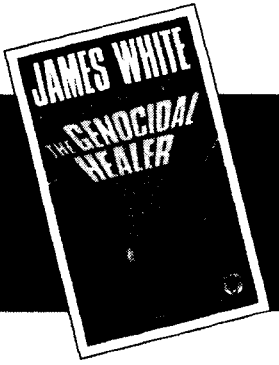

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dollar machine with a pair of ten-dollar garden shears, Sanders thought, but he knew Johnson wasn't thinking that way. To her mind, gardens were something a *person* took care of, personally. Gardening was not work for servants, but a task of pride for a house-proud property owner. LuAnne Johnson was mad because, in her eyes, the robot was acting like it owned the place.

Sanders shook his head sadly. Like so many people, it seemed that Johnson's feelings for human-shaped machines never got past fear and contempt. Suppose this case worked out the way it might, and people like her were forced to deal with *machine*-shaped *people?* "It's not a robot, LuAnne," he said. "A full robot would have noticed us. It's an HTM. A Humanoid Teleoperator Machine, run by remote control, probably from inside the house."

"Robot, HTM, cyborg, remote," she growled. "All the lousy same tin boxes prancing around like people."

Good to hear such an enlightened, informed opinion, Sanders thought. Phil knew LuAnne Johnson barely well enough to call her by her first name. The two of them had eaten in the same diners, been at the same roll calls, off and on for years, but never had had much to do with each other before today. Phil had been hand-picked to perform this arrest, but it was clear that Johnson was here through random selection, along for the ride because doctrine called for two cops on a murder bust, and she was available, her regular partner out sick. How much of her homework had she done? "LuAnne, you know much about this case?" he asked, pausing on the way up the long walkway.

Johnson stopped, turned and looked back at him, squinting a bit in the morning sun over Phil's shoulder. "Just that we've gotta bust a frigging vacuum cleaner, that's all."

"That's what I thought." *Doesn't anyone in the field ever read the background data?* Phil wondered testily. The police datanet was excellent—it could pull up a complete national police record on a suspect, along with any other public knowledge, instantly. Why didn't the street cops ever use it? "I checked the background datasheet on this one before we left the station," Phil said, braving her contempt for going by the book. "Lots of news clips in the file. There's a few details you ought to know. One, Suzanne Jantille is a criminal lawyer. A good one. Maybe she'll take the case herself. Two, Bailey and Jantille were both in a bad road accident six months ago, last December. In a public cab when its programming shorted out. The cab rammed into a wall."

"So?"

"So they both got mashed up pretty bad. The news reports say it put Bailey in a powerchair. No report on what happened to Jantille."

"And what does that mean?"

"Either that she got lucky, walked away without a scratch—or else that it was really bad. So bad she saw to it her condition was not made public."

"So, like, she might be in a powerchair too?"

"Or worse," Sanders said, a bit stiffly.

Suddenly Johnson understood what he was driving at, and her face screwed

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up into an expression of disgust. "You saying she might have got herself *cyborged?*"

"Exactly. I don't know one way or the other. But it is a possibility. The point is, this case is going to be tricky enough as it is, without her house monitors recording you showing some kind of prejudicial reaction. The prosecutors will be flaming mad if we dump a police discrimination charge into the middle of this. So you just tell yourself cyborgs are people, with equal rights under the law. I don't care if you *believe* that, as long as you *act* like you do on this bust. The chief will have our heads if we screw this up. Got it?"

LuAnne Johnson glared at her partner. But Phillipe Sanders was a man who stood his ground when he knew what he was talking about. She had seniority, but he was right. He looked her back in the eye with steady calm. After a heartbeat, she sighed and nodded. "Yeah, I got it."

They turned and walked the last few yards up to the front porch. They mounted the steps and came to the door. Johnson nearly made the gaffe of knocking, but stopped herself in time. It wouldn't be smart to start off with a privacy violation, not in *this* neighborhood. A house like this was certainly smart enough to see there were two cops at the door, and smart enough to know what to do about it.

"May I be of assistance, officers?" the door asked. It was a perfect, golden voice, dripping with refined courtesy, practically singing the words at them.

Johnson jumped a little and stepped back. She hesitated a moment, clearly uncomfortable with the idea of talking to a house. Sanders shook his head sadly. No doubt Johnson liked it back in the rough part of town, the poor parts where no one had talking machines to baffle her. Personally, Sanders couldn't understand what the big deal was.

"Metropolitan Police," Sanders said, taking over. "We have warrants to serve at this address. Advise Madame Jantille." *That* was the way to handle artificial intelligence. No pleases, no thank yous, just straight statements and clear orders. ArtInt machines were not entitled to human courtesy. Phil Sanders was careful not to offer them any. Politeness led straight into the human reflex of assigning social status, and then to speaking according to that status. Trouble was, robots did not *have* social status, and therefore it was impossible to choose a correct manner of speech. Formal, informal, respectful, curt, nasty, deferential—however you acted, it would be wrong, and the machine would respond with urbane courtesy, rendering your treatment of it utterly inappropriate, and throwing you off altogether. Far better to ignore the machine's social advances and stay in control.

"I am informed by Madame Jantille that she will not speak with you voluntarily."

"That's fine," Sanders said. "It's Herbert we're here for, anyway."

There was the briefest of pauses. They had surprised the house, and small wonder.

"I am to under-stand that you wish to-speak with the house maintenance unit Madame Jantille has nicknamed Her-bert?" the house asked, in the slightly sing-song cadences of a con-

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fused artificial mind.

Johnson suddenly lost her patience. "Not speak with it, *arrest* it." She spoke the words with obvious embarrassment, clearly tired of standing on someone's porch arguing with a house. "We have a legal warrant for its arrest, and warrants to search the house for it if need be. You programmed to deal with *that*, you goddamn tin box? Or do we get to break down the door?"

Sanders looked at his partner in shock, his blood running cold. Was Johnson crazy enough to go up against the self-defenses a place like *this* must have? He fervently hoped his monitor link to the car was working. They might *need* help.

"Of course," the house replied smoothly. "*All* house operations systems are programmed for full cooperation with peace officers." The camera over the door swung out and down on a long flexcable. "If you will present each page of the warrant to my camera system, and allow me to record your names and badge numbers, I will be able to cooperate with your warrants."

"Don't act like you've got choices," Johnson sputtered.

"Calm down, LuAnne," Sanders said. "The damn thing *doesn't* have a choice, that's the whole point. Didn't you study the tech bulletins on house systems? They're programmed to keep the place buttoned down tighter than a drum, an absolute injunction." He nodded at the camera and the house. "The damn thing's a computer. Unless Jantille authorizes otherwise, the only way we can override her command priority is by running a by-the-book warrant review, with all the home owner's legal rights observed to the letter. *If* we do all that, it can open up. Otherwise, it's a flat impossibility."

"That what you do down in the robot pool, memorize that tech stuff and the legal crap?" Johnson asked.

Phil did not like people calling his work place the robot pool, and he was starting to feel more than a bit irritated with Johnson. She seemed to feel ignorance and crudity were positive virtues. "Why not?" he asked snappishly. What the hell was wrong with studying up, learning your job? "The point is that, without an override, the house can't open up."

"Then why the hell doesn't this Jantille do the override if she's home?"

"She's got rights," Sanders said, trying to regain his patience. "Like against warrantless searches. She's exercising that one now, that's all. She's a lawyer, remember? Maybe she's in there figuring that if she makes us jump through all the hoops before we make the bust, we'll get mad and screw up somehow. You just came close to making her right, threatening to bust down the door. That what you want to do?"

Johnson glared at him again, and didn't seem about to give him an answer. She glanced at his monitor pocket, and Sanders understood. She had just remembered that everything was being recorded back at the car. She didn't want to get in any deeper.

Sanders sighed. "Here, give me those warrants," he said. He took the papers, opened them up and held them flat for the camera, keeping each page in view for a full thirty seconds. Then he faced the camera himself, allowed it to get a good look at his face and badge.

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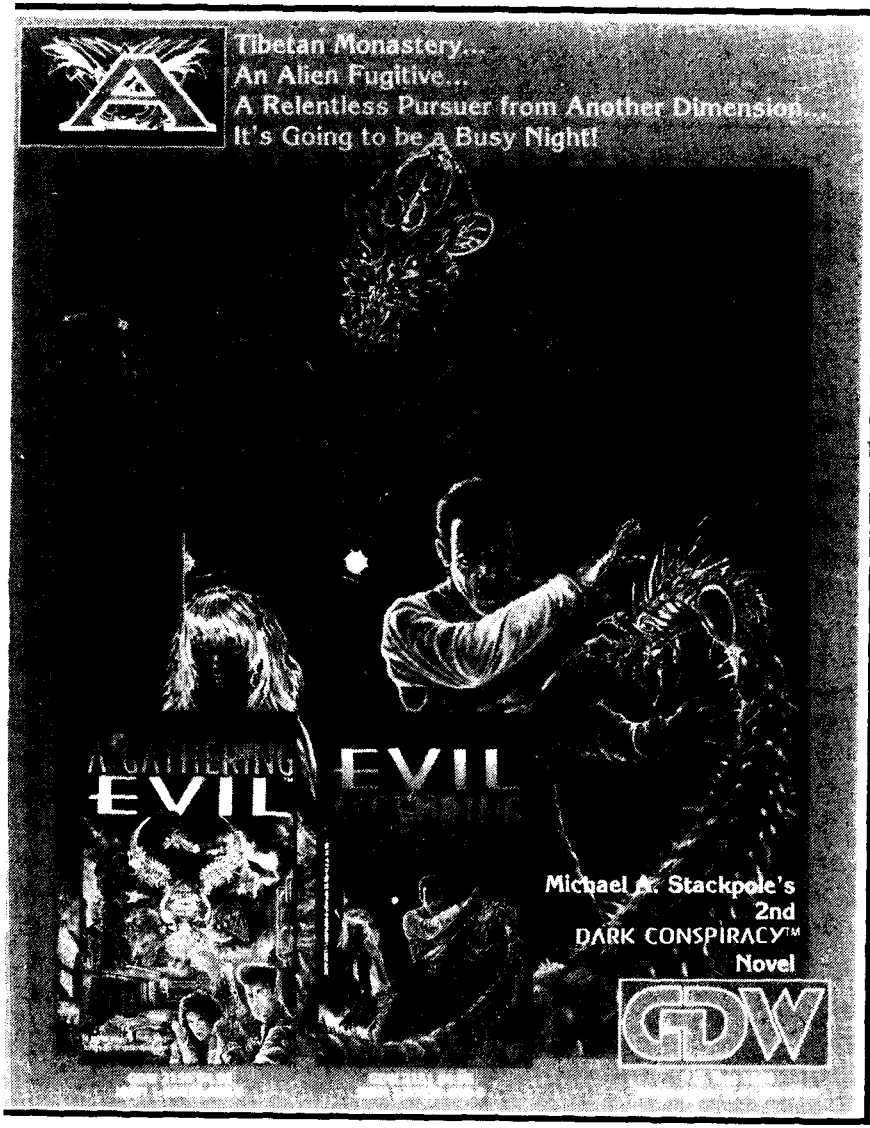
EVIL ASCENDING



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"Patrol Officer Phillipe Sanders, badge number 19109." He nodded toward Johnson to follow suit, but she hesitated.

"Come on, for God's sake, LuAnne."

She stepped forward and muttered into the camera mike. "Patrol Officer LuAnne Johnson, badge number 18083."

"Thank you, officers," the house said. The door swung open, and the two police officers stepped into a rather intimidating foyer, all cold marble and grand interior vistas. A formal central stairway stood in the middle of the hall, leading upwards to a landing. Stairways led up from the landing to the left and right.

Sanders and Johnson stepped inside and stood in the foyer, craning their necks to look either way down the great hall that ran the length of the house.

"So now what?" Johnson asked.

Sanders shrugged. "I guess we—"

"Madame Jantille is coming now, officers," the house said.

Sanders heard the sound of footsteps behind them and turned around. Coming down the hallway from the far end of the house was the figure of a woman, tall and lean, honey-brown hair done up in a bun, dressed in a neat business suit that erred slightly on the conservative side. She looked vigorous, alert, healthy and confident. Not like someone who had barely survived a car crash six months before.

But then Sanders noticed what was wrong. She was a remote. Judging by her sharp intake of breath, Johnson caught it at the same moment he did.

"For God's sake, we gotta talk to *her?*" Johnson said in a half whisper.

"Quiet!" Sanders hissed urgently. "Don't let her freak us. We act professional, do our job, and get the hell out of here."

Suzanne Jantille stepped into the foyer and looked at the two of them, more than a bit severely. "I have read the warrants," she said in clipped tones. "What is this nonsense?"

Right down to business, Sanders thought. No hellos, no pleases or thank yous or social niceties. *Treating us just the way I treated her house*, Phil thought. "It's no nonsense, ma'am. These are legal warrants, and our orders are to serve them. As I'm sure you realize, you don't have much choice in the matter."

Suzanne Jantille clasped her hands together in front of her, knitting her fingers up into a tense knot. Her face was expressionless. "You intend to arrest my vacuum cleaner for the murder of my husband?"

Sanders looked at Johnson, but she was clearly happy to let him do the talking. Feeling more than a bit foolish, he nodded. "Yes ma'am, that's right."

"I was not aware that inanimate machinery was liable under the criminal code. Do you generally arrest guns and sniper knives as well?"

Phil Sanders reddened visibly. "The US Attorney Julia Entwhistle is of the opinion that your house maintenance unit, your, ah, vacuum cleaner, is *not* inanimate, but a person. And further, that it was instrumental in your husband's death."

"That is flatly ridiculous. Herbert can't even speak anymore. Hasn't since David died."

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A tiny alarm bell went off in Phil's head. "Doesn't speak anymore?" he asked. "You mean he *used* to speak?" Lots of robots talked—but not house maintenance units. There wouldn't be any point to it. The things didn't have enough volition to make speech worthwhile. So why make an HMU talk—and what could make it *stop* talking?

Suzanne Jantille looked down, away from Sanders. "David was working on Herbert, tinkering really, just before he died. He tinkered a lot. I supposed David disabled the speech system for some reason, and Herbert hasn't talked since. That's all."

"But why—"

Suzanne looked up again, collecting herself. "I am not required to answer your questions," she said sharply. "And I regard this whole situation as absurd."

"Ma'am, however you regard it, we are going to serve these warrants," Phil said. He concentrated on keeping his voice politely firm.

Suzanne Jantille stopped and regarded each of the two officers for a long moment. "Very well. If there is to be some sort of legal charade, I see that I have no choice but to play in it. House, order Herbert to come here."

The three of them stood in awkward silence for a long moment, and then a slight mechanical noise came from the upper landing. The police officers looked up and saw Herbert—it had to be Herbert—coming down the stairs.

Phil took a good long look at the subject of his arrest warrant. Herbert, he decided, looked like an oversized scuba tank with six stocky, multijointed mechanical legs attached.

Servo motors whirring, Herbert eased his long body down along the stairs and smoothly made his way to the ground floor. Sanders knew home maintenance units, had built a few himself, and had expected Herbert to move as awkwardly as the HMUs on sale at Sears. But this unit was a custom job, not a mass-produced consumer model. Sanders guessed the basic chassis came off an industrial maintenance machine, stripped down and then souped up. However Herbert was built, there was nothing clumsy about him. Instead, there was a strangely smooth and perfect mechanical grace to his movements. Somehow he reminded Sanders of a slow-moving dachshund—stocky, solid, built low to the ground.

"Ugly little spud," Johnson muttered under her breath as the HMU arrived at the bottom of the stairs. Its legs locked at the knees and wheels extruded from the bottoms of its feet. It rolled forward and stopped about a foot in front of the two officers.

Phil had a real affection for the machines he worked on. To him, Herbert was anything but ugly. But even though Phil admired Herbert's lines, his obvious functionality, Herbert was certainly an *unusual* machine. His main body was a cylinder about five feet long and two feet in diameter, painted a gleaming greyish beige—a shade no doubt selected because it would not clash with any color scheme in the house. At the moment, Herbert's body stood about waist high to Phil, but the legs could obviously telescope higher or lower. It looked as if the rear pair of legs were designed to work in biped mode as well, the body capable of swiveling into an

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upright position over them and locking into position. Where the face should have been, was a collection of nozzles, spigots, and hookups for cleaning attachments. A pair of camera stalks extruded themselves from the head and regarded the two officers, one eye on each cop.

There was nothing even slightly anthropomorphic about the machine, and that was odd. For an industrial machine looks didn't mean much, but they sure did to home consumers. Every home robot on the market was designed with at least *some* effort to make it roughly humanlike, or at least animallike. Even in this day and age, people found self-mobile machines disconcerting—especially the ones that could talk. Robots made people jumpy—and so the manufacturers struggled to arrange sensor clusters into facelike arrangements, or made their robots in the classic tin-woodsman shape, or else in the shape of a familiar animal, whether that made functional sense or not. Some makers even gave the damn things skin and hair, put toupees on the humanoids and *fur* on the animal forms.

The very idea of a furry robot upset Phil. Such absurdities offended his sense of good design. Herbert, though, carried things to the other extreme. Herbert's design and construction utterly shouted money, everything sleek and perfect about him, and yet he bore not the slightest resemblance to a human or to any animal. He even had six legs instead of four. With a sudden shift in his imagination, Phil saw Herbert not as a long-slung dachshund, but as an insect grown monstrously large. Six legs, long body, complex head parts, even eyes on antenna stalks. The design would give half the population the heebee-jeebees. Why would a professional like Bailey custom-design such a thing? Strange, strange, and strange again.

But all those points were obviously going right over Johnson's head. She just wanted to get this over with, and clearly did not want to address Suzanne Jantille directly. She nodded at Herbert and gestured impatiently toward the door. "All right, you, come on, let's go," she said.

There was something in Jantille's posture that gave Phil pause, spoke to him of a warning. She was a lawyer watching a bust. What was *she* seeing here? "Hold it, LuAnne," Sanders said softly.

"What? Do we have to wait while it finishes dusting?" Johnson asked savagely.

Sanders wanted to grab LuAnne and shake her, but he settled for leaning close and whispering fiercely in his partner's ear. "We've got to do this right. Think it out. Jantille's watching, and I'll bet you next month's pay the house monitors are recording us, sight and sound, right now," Phil hissed. "For that matter, *my* monitor is recording into a sealed databox on board the squad car, and if I shut down, we're going to look really bad on the record, as if we've got something to hide. Someone *some* time is gonna pull the recording and look at it, sooner or later. So try and look good. We *can't* make a defective arrest."

Johnson looked stunned. "Wait a second. Are you telling me that—"

Sanders shrugged. "You've got to do it right. *That's* what I'm telling you."

Patrol Officer LuAnne Johnson could

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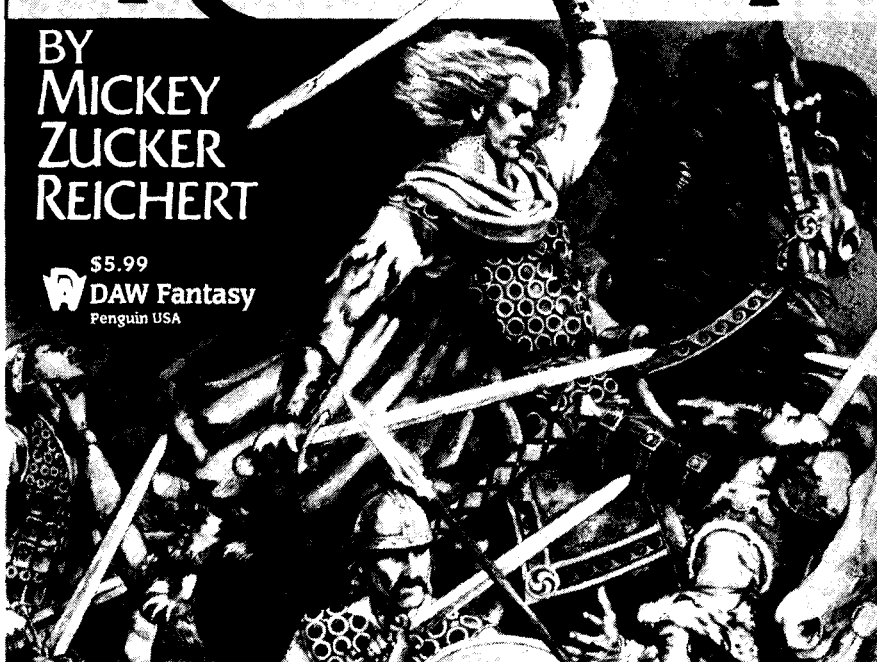

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not stare at Sanders. "What is it with these tech guys?" she whispered back. "Always finding trouble." She shook her head in wonderment and knelt down in front of the home maintenance unit. Phil watched as the two eye stalks swiveled around to look at her. "Ah, ah. Herbert," she said. "I am arresting you on the charge of murder in the first degree. Anything you say can and will be used against you in a court of law. You have the right to remain silent. You have the right to have an attorney present during questioning. If you cannot afford an attorney, one will be provided for you."

LuAnne Johnson glared up at Sanders, and then looked back at Herbert. "Ah, if you understand each of these rights as I have explained them to you, beep twice."

A double tone came from inside Herbert's speaker, and LuAnne stood up. "All nice and legal," she snarled as she stood up. "Think that'll make 'em happy?" she asked.

Sanders thought about all the cans of worms this case was going to open and shook his head. Maybe it was time he bent the rules. This case could mean nothing but trouble for the police. Maybe a little publicity now could give them some damage control. There was a reporter he knew slightly. Maybe *that* was why Chief Thurman put him on this. Maybe the chief had hoped Phil *would* talk to someone.

At last he answered his partner. "LuAnne, I don't think *anything* about the case will make anyone happy for a long, long time."

Event download from auxiliary unit.

Identity Sequence:

I am Clancy Six.

I work at the Washington Post *as a courier and messenger/delivery unit.*

Event playback download.

Storage code header detected:

Event coded for permanent archival storage.

Send storage reason query.

Reply:

Reason (1) police involvement.

Reason (2) unusual event.

Reason (3) subject's attempt at concealment.

Reason (4) subject's unusual interest in Clancy system.

Send permanent archival storage approval.

Event playback begins:

I am Clancy Six.

I am working on the first floor when a call comes, summoning me to the main entrance. I see a police officer there. (Image transmission: still image, man in police uniform. Note badge and name tag removed, civilian jacket over uniform, sunglasses.)

I say "Yes, sir, may I help you?"

The man says "Yes, please give this datacube to Samantha Crandall. Do you know her?" He hands me a standard datacube. The datacube is unmarked.

I take the cube.

I say "Yes, I know her. She works in the sixth floor newsroom." I wait.

After a moment he says "Oh, yes, of course" and gives me a ten dollar bill.

I take the ten dollar bill and say "I will give the package to her."

The man turns to go, and then turns back to me. He looks at me carefully.

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He says "You're part of a Muldoon Consortium, aren't you? How many units are linked into the system?"

I say "Yes, we are a Muldoon. We consist of eight mobile auxiliary units and one stationary main processing unit."

He says "I thought so. You're part of a very sophisticated system. What is your group name?"

I say "Clancy. I am Clancy Six."

He nods and says "Clancy, you tell your owner that you are a very fine machine. Muldoons are very well made. Goodbye." He turns and walks away.

I am Clancy Six.

Event download concludes.

The door of the editor's office swung open and bounced off the newsroom wall with a crash. A very angry man stood in the doorway. Samantha Crandall looked up in time to see a hopping-mad Gunther Nelson headed straight for her. Oh, hell. If he was headed out to meet the public, or represent the paper, Gunther Nelson always looked sharp, vigorous, well-groomed. On other days, on days like today in the office, out of the public view, he didn't make the effort. He looked rumpled and old. He was a dark-skinned black man, with a deeply wrinkled face, and deep-set eyes that made him look like a peevish owl.

"So do you want to tell me what the hell is going on around here?" Gunther Nelson demanded the moment he was in range. Heads turned all over the newsroom. "I come back from a meeting with the publisher and find some damn fool story about the cops busting a vacuum cleaner. Did someone change the paper's name to *The National Perspirer* while I was out?"

Samantha Crandall froze for a half moment before she was able to paste a slightly false grin on her face. She looked Gunther straight in the eye. She even repressed the reflex to take her feet off her desk and instead left them propped up where they were. "Naw, the *Perspirer* wouldn't take this story. After all, it's true." Best to bluff this one out and hope he calmed down. She shrugged and tossed her computer keyboard back on the desk. "If it's crazy, blame the Feds, Gunther. This is their ball game, except they had to call the local heat in to make the pinch. A guy I know on the D.C. police got disgusted and leaked it to me. He wants to make the federal prosecutor's office look bad. Do we wanna cooperate?"

But Gunther wasn't calming down yet. He put one meaty hand on each side of her desk and leaned in over her. "Yeah, right. Standard procedure. The FBI *always* calls in local cops for assistance in busting major household appliances. If they want to go bananas, how come they need the Washington police to help? Can't they go crazy by themselves the way they usually do?"

"Simple. Murder isn't a federal offense. Never has been. No federal statute against it. So, even though the Feds developed the case, they needed the local force to make the arrest. The FBI's been all over the District cops, pushing them into the investigation, and the US attorney for D.C. is running the show herself."

"Yeah, and you love it," Gunther muttered, slumping down in the seat by Sam's desk. That was Gunther for you, Samantha thought—he'd blow in shout-

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ing his lungs out, but it never lasted. Just a guy that needed to shout a little before he could have a regular conversation. Sam watched her boss with something close to affection as the older man stared back at her.

"So how the hell is it I don't know about any of this?" Gunther asked.

"Sorry boss, you were literally out to lunch. My cop friend handed the datapacks to a Clancy just after noon. Been working it up ever since." She glanced at the wall clock. Four P.M. "Funny how the time flies. I guess I just got involved and forgot to phone down to you."

"Don't gimme that crap," Gunther said. "I hear it every time you get yourself some fruitcake story to play with again." He sighed and shook his head, ran his finger through his bushy, disheveled hair. He gestured vaguely toward Sam. "So *talk* to me. Why in hell did the cops bust a vacuum cleaner on murder? And why the hell are the Feds hungry for it?"

"You won't like it," Sam said, grinning even more widely. "The Feds say the vacuum cleaner is really a mindload of the guy who built the thing. Trouble is, mindloading turns the subject's brain into something out of a pithed frog. It's fatal. The D.C. cops just busted this vacuum cleaner guy on a charge of murdering its owner by mindload. They arrested him for murdering *himself*," Sam said. "The Feds say this guy, whatshisname—" she leaned precariously forward to read the computer display—"this guy David Bailey killed himself three months ago. Rigged up an illegal mindloader and put his head under it. I got a copy of the indictment. The theory goes he was dying already, and didn't like the idea, so he pumped his mind quote 'into a high-end storage matrix, said matrix hidden in the house maintenance unit' close quote—the vacuum cleaner. I've been trying to thread through the logic and I think I have it straight. If, and it's a hell of a big if, you accept the theory that the killer—David Bailey—is allegedly alive inside the vacuum cleaner, then it all falls into place. There is no doubt that a death—that of David Bailey—took place. So, if the Feds can prove that the vacuum cleaner *caused* Bailey's death, and can prove that the vacuum cleaner possesses the mind of a human person, and is therefore human, then Bailey's death was, by definition, murder: the death of one person deliberately caused by another person. The Feds say they have the evidence to prove the case."

Gunther shook his head. "That's as twisted a bit of reasoning as I've ever seen, but I guess I can see it. So why the three-month delay?"

"Best I can tell, it just took that long to develop the information. They've been investigating. The United States attorney for the District of Columbia wants *all* dead people to stay that way. She wants a cast-iron ruling that death is permanent and that the legally dead have to *stay* legally dead, and have no civil or property rights. She's been sniffing around for a winnable court case, and now she thinks she's found one."

Gunther grunted noncommittally. "So what the hell are they calling legally dead this time? Brain function ceased? Heart stopped? They've been batting this one around for seventy

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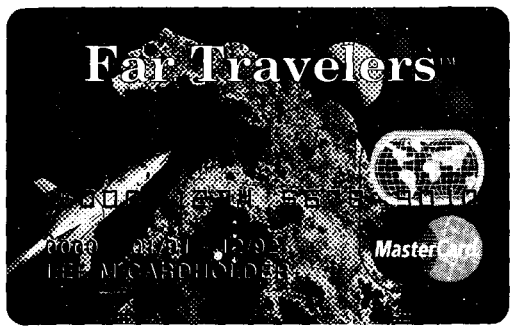

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years, and no one's come up with a definition that always works."

Sam nodded. "Tell me about it. I ran an ArtInt check just for the hell of it, and at least three of the people working in the US attorney's office were at one point legally dead by one definition or another. A Joan Haggerty there was kept on total life support for six hours before they had an artificial heart for her. Attorney Fred Lewis was in a sport-flyer accident and had a flat brainwave for three minutes during *his* trauma operation, and they have a Peter Wilcox there, heart attack victim, who checked out all the way—heart, brain, respiration, *all* vital signs down before the revival team got to him."

"You just happened to run a check," Gunther said dourly. "I don't suppose the Feds are planning to use any of those three on the case team, do you?"

Sam gave her boss a parody of a conspiratorial wink, screwing up her face and exaggerating the gesture. "Don't tell anyone, but my bet is *no one* with spare parts, and no one who's been dead, will be allowed to work on the case. Just all-natural types."

Gunther smiled. "I wonder how far they'll take it. Will they take people who wear glasses, or contact lenses, or have had vision correction surgery? Or people with fillings in their teeth?"

Sam looked puzzled. "What do you mean?" she asked. Gunther had a talent for abruptly transforming practical conversations into philosophical discussions. The thing of it was, the philosophy usually ended up meaning something. Which was something philosophy wasn't generally noted for, in Sam's opinion.

"Define a cyborg for me," Gunther said.

Sam thought for a moment. "A human who has been artificially enhanced, or had body parts replaced with artificial components. Like one of those poor crash-victim bastards that're practically just heads on top of robot bodies. There's one in front of this building every day, spare-changing people. But it has to be something *big*, like a replacement arm or heart. Nothing as minor as a filling."

"Says who? And if a filling doesn't qualify, what does? What's the *minimum* amount of artificial replacement needed to qualify as a cyborg?" Gunther asked. "You say a whole body replacement or even just an arm is big enough, but a filling is too small. How about bridgework? Is *that* big enough? Or dentures? Or hearing aids?"

"Those are all things you can live without," Sam said.

"You can live without an arm, and you've said an artificial arm makes you a cyborg. Or at least an arm you can *tell* is artificial makes you one. Everyone accepts you just fine if they can't tell you've got replacement parts. How about a pacemaker? My daddy has one of those he needs to stay alive. That make *him* a cyborg?"

Sam shook her head uncertainly. "I don't know."

"And *his* heart stopped for two minutes during the implant. The doctors had to restart his heart. That make him an ex-deader, too?"

"Dammit, Gunther, *I'm* not the one trying to set definitions! Ask the attorney general. Or if you're so smart, you tell me. What is a cyborg?"

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"*I* don't know where to draw the lines. Between alive and ex-dead, or between natural human and cyborg. How much do you have to replace before someone stops being human? How much has to be *left?*" Gunther thought for a minute. "I'm starting to see why the Feds picked this case. If this guy Bailey really *has* pulled it off, and he's put his mind inside that tin can, that's *all* that's left of him: his mind, nothing else. His body's dead and buried. The ultimate cyborg. You could say that there is nothing left of Bailey but the *idea* of Bailey. Is he alive? Can he be, with no organic tissue left? I don't know. But if there's any cyborg they can prove is dead, it'll be one without a body left. It'll set them some nice precedents, get their foot in the door to start chipping away at the rights of other death-avoiders."

"You realize something else," Samantha said. "If this guy Bailey *is* still alive, legally alive—then don't all the robots with mindload-based minds have to be ruled alive as well? That's practically every true robot made. Are *they* human? Or part human? And what the hell would part-human mean?"

Gunther Nelson put his hand to his chin and rubbed it thoughtfully. A faraway look came into his eyes. "So the question comes down to when you stop being human." He spoke in a half-whisper. "I'll tell you the secret definition that US Attorney Julia Entwhistle is *trying* to put forward, without admitting it. Maybe she hasn't even admitted it to herself. But deep in her heart, she believes that any poor damn bastards modified enough that just the sight of them makes other people uncomfortable, any poor suffering sods kept alive by means that seem a little strange, should be denied their rights under the law." Gunther drummed his fingers on the arm of the chair.

"That's not right," he said after long consideration. Gunther Nelson sat and thought for a minute. "You go out there, Sam," he said at last. "Go out and get that story."

Interlude

Playback: action judgment test.

Recall mode.

Incident playback begins:

[*Voice Input Sound channel four: "Ah, ah. Herbert. I am arresting you on the charge of murder in the first degree. Anything you say can and will be used against you in a court of law. You have the right to remain silent. You have the right to have an attorney present during questioning. If you cannot afford an attorney, one will be provided for you. Ah, if you understand each of these rights as I have explained them to you, beep twice."*

Call Parser: Scan for ops orders.

(1) Order located.

Warning: Parser returning error codes. Main logic override: Ignore error codes.

Order: "Beep twice."

"Beep" parsed as "TONE" command.

Result instructions set:

Send sound command: TONE.

Send sound command: TONE.

Routine completed]

Playback of routine complete.

Evaluation: Previous Parser errors corrected. Errors in playback mode

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parsing detected: Beep command conditional, command condition not satisfied. Conclusion: error in action.

I did not understand.

Error detect status routine. Call error check subroutine. Examine-categorize-new-locale. Verbal cues garbled. Call subroutine: Scan-and-pattern-match.

Pattern Match Result: storage closet/area shelves. Contents: misc., disorganized.

Who am I? I wonder. *What place is this? Why am I here? What should I do?*

But I am lost in this strange sea of the mind.

Input flag: Queries. Call subroutine: Parser.

Store Parser results: Query array(4).

For I = 1 to 4 read array(I)

(1) Who am I?

(2) What place is this?

(3) Why am I here?

(4) What should I do?

Call subroutine: Query-tree, array(1)

ID ROM Call Result: ID ROM HMU Custom Ser #00001.

RAM call result: Davi?? ROM/RAM compare match fail. Store result.

Call subroutine: Query-tree, array(2).

Result: Disordered storage area. Store result.

Call subroutine: Query-tree, array(3).

Result: unlabeled logic set: I guess they want the place cleaned up.

Result: ROM default: No action.

Call subroutine: Query-tree, array(4)

Result: unlabeled logic set: Might as well get started.

Result: ROM default: No action: Action Result

Main Logic (error-flag): Cleaning.

Result, default ROM: (error-flag) No action.

Call subroutine: Query tree result:

Polling result. Call subroutine: Parser.

Result Instruction Set: Clean up.

CHAPTER TWO

A Prisoner's Visit

Suzanne knew she had to take the case. There was no question of that. If for no other reason than that Julia Entwhistle was expecting that Suzanne would not. Besides, damn few competent attorneys would want to take on this one. She was not going to waste time searching for a lawyer when she could do it herself.

If she had the courage.

Suzanne Jantille sat up in bed. She was home alone, alone in her bedroom, alone in the cold marble palace of a house that no longer *felt* like home. Glad for once that she was so very alone, glad there was no need for shells and pretenses just now. She sat, and she thought. Thought about a case. A legal case. Hard to consider it in those terms, but necessary. Six months now, since the accident, since she had worked at all, and years since she had tried a case.

And now she must consider a case wherein the government claimed a man—and not just any man, but her husband—had survived his own self-murder, his own suicide. The idea was insane. Her husband was dead. That much she ought to know. She had found the body herself, last March. She could still see David's cold, stiff corpse

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slumped over in its powerchair, surrounded by all his equipment.

Dead. Although horrified by the sight, she had not been altogether surprised. The doctors had warned him that he might suffer a sudden collapse.

And even on the day she had found him, she had some small part of her that had wondered if he *had* killed himself, found his own release from the debilitating pain. If it were true, she could not blame him. She had seen his endless agony in the three months between the December accident and his death in March. In a horrible way, she would even prefer it to be a suicide, not the meaningless, random stab of the Grim Reaper's finger. If the death had been by choice, not chance, that at least provided a reason, however ghastly and morbid it might be, for her husband's death. If only they had had the chance to say goodbye first.

But killing himself would not be in character—and David was a man who always said his goodbyes.

And now this insane accusation that he had mindloaded himself into that damned vacuum cleaner. Absurd.

Suzanne stopped and thought a moment. Or *was* it so absurd? She forced herself to face the possibility that the Feds had it right. Something cold gripped at her the moment she allowed herself the thought. She had always chided herself for not knowing enough about her husband's work. She knew that virtually all robot brains were based on mindloads. She knew that most robot brains had only 2 or 3 percent of the capacity needed to hold a full human mind. She knew that her husband had been working on ways to increase that maximum. Suppose he had done just that?

Something sprang into her awareness, something she had held bottled in since the accident. She knew one other thing about her husband. Risks for him were very private things. For David, danger was something you faced alone.

Suppose—just suppose—he had tried this mindload, hoping, expecting, to escape his pain-wracked body, to deliver his mind safely into a new home? Herbert *had* been in the lab when she had discovered David's body. Suppose he *were* there as a receptacle for David's mind?

The idea struck at her imagination. Not dead, and yet she had buried his body. In a strange way, it had eerie parallels to her own situation.

But she thrust that idea away. Never mind that right now. There were bigger issues here. It was time to think about them.

Assume, for the sake of argument, that David *was* in Herbert, somehow, or *might* be there. Take it a step further.

Assume that someone, someday, *would* find his or her mind stored inside a robot's body. Sooner or later, it would be possible. David had believed that firmly.

What would the law say to those people? What would it do to them? Those were the questions the government was asking. And they thought this case would elicit the answers they wanted: That such person *had* no rights.

The government wanted to say that David, if he was inside Herbert's memory somewhere, had no more innate right to existence than a computer program or a video recording.

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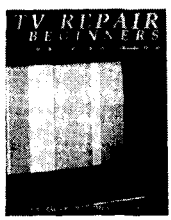

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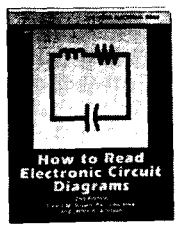

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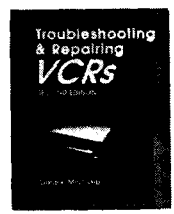

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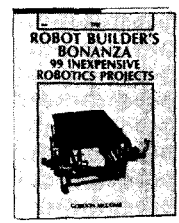

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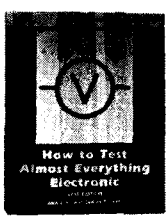

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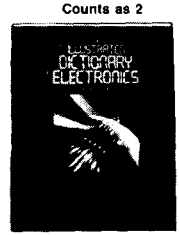

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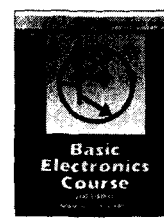

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It was obvious what the Feds were planning, what they were hoping *she* would do if she took the case. *Expecting* her to do, even. After all, playing their way would get her client off on a murder rap.

All she had to do was convince a judge that her client could not stand trial, on the grounds that her client wasn't a person. A ruling like that would establish the precedent that a mind stored in a robot was not, *could* not, be a person.

And it would win them the battle, as well, in the long run. If Herbert the HMU wasn't the human person David Bailey, if David wasn't alive, then Herbert was just a machine, and they could punish him as much as they wanted. They probably could seize him under the anti-mindload statutes, for example. Mindload gear was illegal. Once Herbert was in their hands, they could even execute him—cut the power to the key memory matrices, and wipe out any trace of David Bailey.

A shiver went down her back. The very thought of it. To have lived for three months with the electronic ghost of her husband, and not know it. . . .

But wait a moment. She took hold of herself and forced her thoughts into more disciplined channels. In there, not in there, did not matter from a legal point of view.

Absent any proof to the contrary, and given the size of the stakes in terms of precedents to be set, she would *have* to operate on the assumption that the Feds had their story straight.

But that was not going to be easy. After all, even if David's soul were stored in Herbert's memory matrix, David was utterly incommunicado. Herbert no longer spoke. She could not question him, or advise him, if he could not communicate. These days Herbert couldn't handle anything more than simple yes-no questions that could be answered with one beep or two. Even when he had been able to speak, anything much beyond the complexity of "Have you vacuumed upstairs?" had been beyond him.

No help from Herbert then.

But no hindrance, either. That could be useful, in many ways. If she could somehow maneuver things so that the issue was one of *dis*proving his alleged humanity, and then force the burden of proof off onto the Feds, Herbert's muteness would be a positive boon. They could question him all day long and not get a word out of him. The lawyer in her savored the idea of such a convoluted legal tangle. But it was off the main point, at least for now.

She wondered how the Feds had developed their information—but that too was off the point just now.

For now, the main point was clear: For the sake of David, if he *was* in there, and for the sake of the precedents being set, she would have to treat Herbert like a person every step of the way—and insist that everyone else do the same.

And the first thing a lawyer did on a murder rap was go visit the client in jail.

Never mind that she dreaded the very idea of leaving this house. Remote persons did not like to travel.

The van knew where it was going, which was just as well. Suzanne was no longer licensed for manual driving, and

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never could be again. She had thought to use the drive to collect her thoughts, but her mind would not focus. There was too much of the outside world to see through the windows, all the minor miracles of everyday life that she had not seen for these many months. Children laughing. Dogs on leashes snuffling through the grass in search of intriguing scents. A blue sky, a fresh-painted house, people walking the street, busy about their own concerns, the new fashions and styles on parade.

It was too much for her lonely eyes after all the months of self-imposed exile. All too soon, she noticed the van slowing. She looked out the window as it parked in a handicapped/utility spot and saw that it was extruding its link lines, tapping into power and comm ports, activating its relay links, ready to keep her in touch. She had arrived.

After a careful check of the vehicle's relay systems, Suzanne stepped out into the cool gentle air of an early Washington spring. She stood on the curb, hesitating.

She was new to all this. She had never really been out around people since her surgery and therapy after the accident. She had always found good reasons, real or imagined, for not going out in public. Now there was no choice in the matter. This was her baptism of fire, her first journey outward, made under the most challenging of circumstances, without any chance for practice or warm-ups or confidence-building beforehand.

Too late to worry about all that, she told herself firmly.

She looked around more carefully. It was a busy street. People, courier machines, a cyborg selling hotdogs from a cart, two or three police HTMs wandering about, obviously in security scan mode.

The main thing was that what she saw matched the map she had memorized. They hadn't rebuilt the place since the map references were updated. Therefore, the map references to her ultimate destination should also be reliable. In other words, she knew where she was.

Confirming that was a distinct relief. A remote was much like one of the rare blind persons who could not be fitted with some sort of vision system. Placed in a known territory, both blind person and remote could work with impressive skill and confidence. But either was in big trouble when dropped into the unknown. The remote's advantage was in being able to refer to maps of any area as needed, assuming the data was available.

But such things were trivial, Suzanne told herself. A blind person's advantages over a remote were, of course, limitless. Suzanne Jantille would have traded places with a blind person in a moment. But time to get on with it. She stepped forward, a bit hesitantly at first, and then with more confidence, toward the front entrance of the seedy old Fourth District Police Station.

Suzanne hadn't been here in years, but memory served, and she could walk straight to her destination without checking the building directory. It gave a small, but needed, boost to her confidence. She went inside.

She expected the double take from the desk sergeant, but that expectation did not make it any more pleasant to experience. For the rest of her life, ev-

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ery time she went out in public, *that* would be the response.

At least the sergeant managed to regain his composure instead of staring at her in slack-jawed amazement for a half hour. "Yes, may I help you?"

"My name is Suzanne Jantille," she said. "I'm an attorney here to see my client. You are holding him here. David Bailey." Think like a lawyer. The game, the fight, started now.

It dawned on her that she had only worried about the *appearances* of this visit, and not at all about its substance. She wanted to let the cops know she was around. But once she got to Herbert, what, if anything, was she going to say to him? How much, if anything, could he comprehend? Suppose David *were* in there, perfectly able to hear and understand her, but not able to talk back?

"I'm sorry, ma'am, I don't show anyone in lockup under that name."

She regarded him with a cool gaze for a long moment, then read his name off his name tag. "I find it a bit disturbing, Sergeant Wilkins, that the Washington D.C. police force is capable of misplacing a murder suspect." She had known perfectly well her client would not be booked under that name—but it was important to make the effort, show that she did not accept the idea that he was merely a machine. Now her recorder had it all down for later reference.

But that was part of being a lawyer, or a police officer, these days. Incredible how much of their lives were mere performances for the recorders, demonstrations that they had all said and done the right things at the right moments.

Now she had performed her role, and now could ask for her client under his machine name. But to have asked for him by the machine name *first* could be construed to mean she accepted the perception of him as a machine.

Damn it, she was simply asking to see her client. Would *every* action she took in this damn case require such careful maneuvering, such watching after every nuance? "It may be that he is listed under another name, erroneously assigned to him by the authorities," she said. "Try under 'Herbert.' "

Sergeant Wilkins didn't even have to look at his computer display. "Oh, *Herbert*. Yeah, that was a real scene when *he* came in."

"So you do have him in lockup," Suzanne said.

"Ah, no ma'am, we don't," the sergeant said, reddening a bit.

"I thought you said there was a scene when he came in. But you didn't hold him?"

"Oh, no ma'am. We do *have* him—just not in lockup."

Suzanne Jantille felt herself doing a slow burn. She decided to let the emotion out, put it to use as calm, professional anger. "Sergeant, I'm going to ask you a question, but before I do, please bear in mind I'm making a record of this conversation, and that I note your badge number is 11124. Are you *deliberately* giving me the runaround?"

Wilkins reddened more and shook his head. "Ah, no ma'am. Not one little bit at all. It's just that—well, hell. I'd better walk you back myself. Things are kind of confused." He turned and gestured to another police officer as he stepped out from behind the desk. "Sal,

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take over here." He turned back to Suzanne. "This way, ah, ma'am," he said, obviously ill at ease to be walking with her.

Suzanne felt a slight touch of amusement with, and sympathy for, the sergeant, but she didn't allow either to show. No question but that her condition made people uneasy. But she knew there were times when that afforded her a distinct advantage. It was certainly working for her now. She didn't even have to *try* to intimidate the desk sergeant. The poor man was doing it to himself.

He led her down the hallway. "Ma'am, the thing you gotta understand is that we're just a local police station. We're not equipped for anything much out of the ordinary. 'Course I doubt if the FBI and the CIA together would know how to handle *this* one. But we had to decide to put him somewhere, and it just didn't seem smart to put him in with the sort of local boys we get. . . ."

Suzanne followed him down the hallway, remembering the building floor plan as they walked. This was definitely not the way to the lockup. So what was up ahead? She figured out the answer a split second before they got there. The sign over the door confirmed it.

EVIDENCE ROOM. Where they kept prisoners' guns, burglar tools, switchblades, sniper knives, flak throwers. They had locked him up with the other machines, instead of with the other suspects. She stopped and stared at the sign for a long moment.

Suzanne felt a strange flurry of emotions wash over her. First was a sharp, bitter anger at what they had done. Then a burst of gleeful exuberance as she realized how she could use this. Then a drawing in, a warning to herself to be careful.

Sheathed in cool, judicial anger, she stood before the closed door. "I am to understand you have housed him *here?* Sergeant, you have arrested him and charged him with a crime. That right there is prima facie proof that you regard him as a human person, and recognize that he is entitled to equal protection under the law. Do you commonly stuff suspects in footlockers or broom closets?"

Wilkins blushed and shook his head, sweating openly now. "No, no, ma'am. It's just that we didn't know *what* to do with him. He, ah, sure as hell didn't fit in with the other prisoners—and they didn't want anything to do with him, ah, *it*—dammit, whatever you want to call that *thing* in there."

"Your prejudices and those of Mr. Bailey's fellow prisoners are of no interest to me, but I note that your statement has been duly recorded. Thank you, Sergeant." Suddenly, Suzanne was seeing not just a momentary chance to twit the police, but a real chance to undermine the government's case. By locking him up in the evidence room, they were demonstrating that they *did* regard him as a mere machine, not as a person. Maybe she could use that, try to convince the judge that the entire prosecution was based on a charade. They were only *pretending* to see Herbert-Bailey as a person.

Of course, she herself was guilty of the same thing, but for different motives. *Lord, the games we all play*, she thought.

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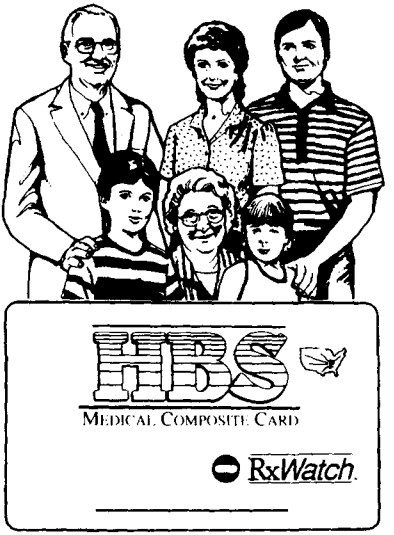

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She stood there, glaring at the police sergeant, until he regathered his wits enough to open the door and usher her through it.

The two of them stepped a bit hesitantly into a darkened room. Seeing by light coming in from the hall, Suzanne realized that the room inside the door was a small antechamber. There was a service window and a door in the wall opposite the outer door, leading to an inner room.

Both service window and inner door were shut now. In years or decades past, there would have been a duty officer sitting on the other side of the service window, watching over the evidence. But locks and security devices were plentiful and cheap, while cops were expensive and scarce. Nowadays they made do with infrared sensors and heavy bars over the window and doors. The lights came up as the building sensors detected warm bodies in the antechamber.

Suzanne peered through the barred window into the evidence room proper. The lights had not gone on in there. "Am I to understand," she asked in a slow and careful voice, "that my client has been left *here*, locked up alone in the dark, in solitary confinement?"

By now the sweat was standing straight out on Sergeant Wilkins's forehead. "Ah, well, ah—"

Suzanne felt a sudden flush of exultation. Play back her recording of this encounter and the entire case would be thrown out of court. It wouldn't even get as far as an indictment. The judge would see that the government was not treating their suspect like a person. It would be even more damning than a defective arrest. If not for that damn smart cop, Sanders, they *would* have had a bad bust—but this would be far better. The government's charade would be exposed and that would be the end of it. . . .

There was a sudden clunk inside the evidence room. The sergeant tapped a wall switch in the antechamber and the inner room bloomed into light. Suzanne saw, and her recorders took down, the scene—and all her hopes for a dismissal faded away. She *couldn't* show the recording of the preceding moments to a judge. Not when the prosecutor would insist the judge see this scene too. She had hoped for Herbie cowering in a corner, frightened and alone. *That* she could sell to a judge as a victim, a target of manipulation whose trial would be a sham. But not this. She wouldn't dare run her records—not when the government could legally compel her to play fair and show this as well.

"Oh my God," Wilkins half-shouted. "Tell him to stop! If he's taken the fingerprints off anything—"

Suzanne Jantille had to stop and stare for a minute before she understood what she was seeing. Well, damn it, he *was* a cleaning robot, and he *did* have infrared vision. What else should she have expected of him?

Herbert the house maintenance unit, Herbert the murder suspect, was in the center aisle of the evidence room, boosted up on his rear leg pair, dusting the upper shelves.

Suzanne sat glumly in the duty room of the police station, waiting to make sure a cell was cleared for Herbie, to make sure that he was actually put in it.

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Beyond that, there was very little left for Suzanne to accomplish, save to kick up a fuss. She had to go through the motions, even if her heart wasn't in it. The desk sergeant was seeing to the cell himself. She felt a mild twinge of guilt for leaning on him hard. He seemed a decent enough sort, eager to go the extra mile to make sure all went well.

Seeing the poor damn machine pointlessly trying to tidy up the evidence room had convinced her: David Bailey was totally, irrevocably, utterly dead. Dusting an evidence room was pure machine-style idiocy, nothing human about it. The last faint spark of hope that her husband still somehow existed in some form was gone.

Besides, the whole issue was moot, anyway. Even if he had been alive in there, she could see now that it was unfit to stand trial—unable to answer questions, unable to communicate at all, only able to obey the simplest orders. A judge would not permit the trial of a flesh-and-blood defendant in that condition, but rule him incompetent.

There was only one mystery left, as far as Suzanne could see. Before David's death, Herbert *had* been capable of speech. Now the machine could not talk, and she did not know why.

But that was a minor point. Herbie was not, *could* not be David Bailey, not by any remote stretch of the imagination.

The whole affair was reduced to a charade—but one that had to be played through, for the sake of precedent in future cases. As far as Herbie himself was concerned, no doubt he would have been just as happy in the evidence room. But he had to be moved to a proper cell in the lockup, for form's sake if for no other reason.

And two days from now she would go off to the courthouse downtown for the bail hearing to get him out of there. Charades within charades. She would play them through, for David's sake. She had no choice.

Finally the sergeant came back with a piece of paper and handed it to Suzanne. "All set," he said. "Took a little doing to get him his own cell down there, had to double up a few other guys who didn't much like it." The sergeant looked concerned for a moment. "Ah—getting him his own cell by himself isn't a problem, is it? I mean, discrimination or anything?"

"How would you handle any other prisoner who might be at risk from the other suspects?"

The sergeant's face cleared with relief. "Same way. Keep him away from the others for his own safety. So it's OK?"

"It's OK. The point is, strange as I admit it must seem, my client *must* be treated the same as any other suspect."

"Thank you ma'am. That's good to know. Always nice to know what the rules are." The words seemed to bubble out of the sergeant, plainly eager to please her, make amends. "We'll do our best. Look, I know it's been a bit of a morning for you. Can I offer you a cup of coffee, or tea—"

Suzanne flinched inside, as Sergeant Wilkins suddenly realized what he was saying, and to whom and what he was saying it. *Always* and forever they forgot, because she tried so hard to *make* them forget, to make them accept her, make them treat her like a person.

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And then would come this same sort of crushingly awkward moment, when a kindly person offered her what she could no longer have, and slapped her across the face with the very kindness and acceptance she so desperately craved.

Because remotes were made to look *like* people, sound *like* people; but they could never *be* people. Never touch, never taste, never eat or drink or cry, any more than any other machine could.

At least they could not cry on the outside. Inside her heart, there was very little left *but* tears. Sergeant Wilkins stepped toward her but she waved him away.

Suzanne-Remote lifted a rubber hand to her plastic face and covered her eyes in sorrow, in rage, in pointless shame. She had planned to go and see Herbert, go through the charade of pretending to meet with her client in his cell—but she had no heart left for games now. She rose and moved like the automaton she was, back toward the refuge of her relay van, and the comforting emptiness of her solitude.

Suzanne-Remote rode home in silence, the familiar gloom of the old depression overtaking her once again. Was life, *could* life, be worth all this?

Her mind flashed back to those terrible weeks just after the accident when she awoke to real-life nightmare choices that came too fast, too hard; awakening from her coma in total life support, the ruin of her body just barely patched up, her mind still reeling.

Then she had seen David—strong, capable David—just learning to control his new powerchair, his legs dangling uselessly down from its seat as he struggled with the controls.

David was there by her side, and she was paralyzed from the neck down, unable to touch him, unable to reach out to him. David was there, and he was desperately wishing that it had been him, and not her, who had lost all use of his body. David was there, barely able to move himself, promising her that he would always care for her.

It had been then that she had chosen the remote, chosen to accept the plastic flesh and steel bone, rather than be a endless, helpless burden on David, himself disabled and despairing. With the remote she could work, she could be active, be a part of the world. Plastic and steel, she told herself, were the price of having some small fragment of her old life back.

And now she could live, even without David.

But was life of any kind always worth the pain? Was life at any cost always worth the price? Was it worth the loneliness, the endless hunger for contact that could never be fulfilled? The longing for acceptance, for simply physical contact, when she and the world knew full well that it was impossible for the world to offer her any such things?

Why go on? she asked herself. Death seemed a very easy solution at times. Tidy. Simple.

But *still* there was something inside her, inside her true self, that could not let that happen. Life, even this ghastly half-a-loaf life of sensory deprivation and staring strangers and loneliness, was precious. The glittering lenses of her remote's robot eyes had seen a blue sky this morning, her microphone ears

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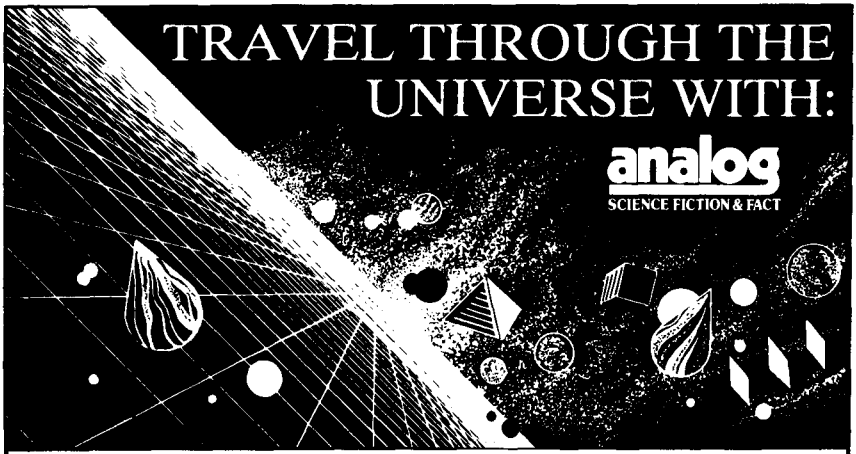

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had heard children's laughter.

And perhaps more precious still, she had been presented with a problem that she and *only* she was truly equipped to handle. The world still had need of her.

Only she knew her husband. Only she would be willing to take this case. Only she, of all the lawyers in the world, could understand the plight of her client. After all, to the best of her knowledge, she was the only Remote Person practicing law anywhere in the world.

And that was funny. The doctors told her there were something like 10,000 Remote Persons in the world. Surely in all that number, there was another R.P. lawyer somewhere, but out of all the people in the wide world, she was certainly the only R.P. lawyer with a robot for a client. One pile of electronics defending another. There was poetic justice there, somewhere.

Suzanne savored the thought. After all, a good irony was one of the very few pleasures still left to her.

Interlude

Where am I?

Connect failure. Ready to resume. Dropping back to default params. Continue low-level ops on background. Message send to memory store: Character garble. Reset vid-lo scan subroutine. Search for link—The day in the park when we were flying kites and the string cut into my finger. Where are the scars? Where are my fingers and my hands—*Reset. Looping back to command interp. init. settings.*

Where am I?

CHAPTER THREE

Interview with a Robot

"I'll take the next question. Yes, dear, you in the back." The matronly black woman in the sensible blue suit leaned forward a bit at the podium, smiled warmly at her questioner, listened carefully, and answered with polite earnestness.

Samantha Crandall was lolling in the middle rows of the auditorium, waiting for the right moment to throw in a monkey wrench. The press conference was interesting in its own right, if for no other reason than it gave her a chance to watch Julia Entwhistle, United States attorney for the District of Columbia, in action. The old girl had a name and a title—and a set of opinions—that should have gone with an officious and priggish personality. That she instead looked and acted like every person's dream-image of the ideal grandmother was disconcerting at best, and perhaps at worst disingenuous.

Not that Sam Crandall worried about any of that, except as it affected her ability to get her story. Entwhistle was to her merely a variable in the equation.

Entwhistle cocked her head a bit to hear the question, apparently judged it to be a hot potato, and turned toward the chief of police. "I believe that perhaps Chief Thurman could better answer that point."

The chief shot Entwhistle a plainly annoyed look before lumbering up to the microphone. Now *there* was a man clearly *not* putting on a show. Maybe *he* was the one to watch when Sam sprang her trap. It was always more useful to read a genuine reaction.

Until the time came to ask her own little question, Sam could think of no better entertainment than watching the

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rest of the press corps slogging through the latest wrinkle in the endless land reclamation scandals. She wasn't covering that story, and there was something downright luxurious in the fact that she had no need to take notes or record or watch the nuances or follow up whatever hints the chief would drop this time. She could just sit back and watch the show.

And quite a show it was. The number of the mayor's friends caught with their fingers in the till was truly amazing. The fact that the chief of police was here next to the US attorney, while the mayor wasn't there, spoke eloquently of how the battle lines were being drawn this time.

And doubly strange, even after all these years, to think that the District of Columbia *had* no district attorney, no truly local prosecutors. *All* criminal prosecutions were handled directly by the Feds, by the US attorney. The District of Columbia, capital of the United States, was not *in* any state, not in any county, so that the jobs traditionally left to state and county-level government were parceled out, most awkwardly, between the locals and the Feds.

In the present case, it was perhaps just as well that the mayor had no control over the prosecutor. He could have sat on a local D.A.—and this particular mayor might well have been tempted to do it. But that, too, was in the grand tradition of District politics. Sam couldn't remember a mayor of Washington who could have been trusted to keep his or her hands off a D.A., given the chance.

There was something dreamlike about the questioning. Sam listened as yet another reporter got up to ask some complex question on land-use fraud. Each side knew this was a public shafting of the embattled mayor, but never could admit it. It was a carefully choreographed ritual, though no one could admit that. Sam, though she was trying to concentrate, almost lost track of the intricacies of the reporter's question, but the chief was up to the challenge and answered it with laborious care. He even managed, with seeming unwillingness, to sprinkle a new handful of political land mines in the mayor's path. There was a follow-up question. The chief responded; more land mines sown. Then a new questioner, who tried to aim closer to the heart of the scandal. The chief listened to the hard-edged question and replied, a bit evasively, nonetheless dropping new and dark hints about the mayor's direct financial involvement. A third questioner rose to the bait, and asked the question straight out. But then the chief backed off, and so did Entwhistle. They had said all they planned to say for today.

There was a sudden flurry of rustling and chairs snapping shut. Sam blinked and the spell was broken. She glanced at her fellow reporters strewn about the auditorium. The party was breaking up—reporters were powering down equipment, gathering belongings. It was time for her to jump in.

She stood and gestured for attention. Time to bring this show out of the murky confines. Gunning for the mayor while pretending not to do any such thing was too much in the way of blue smoke and mirrors for Sam. It was time for something more substantial and direct. "Madame Attorney, Chief Thur-

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man. Perhaps you could respond to a question in another area before you go. I'd like to get both of your comments on the arrest yesterday morning of a vacuum cleaner, accused of murdering its owner."

The matronly gloss vanished off Entwhistle, and her eyes turned to twin angry gimlets zeroed in on Sam Crandall. Beside her, Chief Thurman winced visibly and backed away from the podium. Obviously he had no desire whatsoever to field that one. *Bingo, bingo, bingo*, Sam thought gleefully. She had bet they weren't ready for publicity on this one yet. Which made now the best time to press them.

There was a tittering background rustle in the auditorium as the other reporters waited for Entwhistle to dispose of the ridiculous question.

A lot they knew, Sam told herself. Entwhistle leaned into the podium hard. "That is an entirely unfair characterization of the case, as I expect you know quite well, young lady."

"But ma'am, did you not personally request a warrant to arrest quote 'a house maintenance unit commonly known as Herbert' close quote? I have a copy of the warrant here if you need to have your memory refreshed. I'm told Judge Harris took a fair degree of convincing before he would sign it." *That* was a guess, a shot in the dark, but Sam couldn't imagine Harris *liking* the warrant.

The revelation that Sam had a copy of a real warrant—and the sight of Entwhistle's angry reaction—woke the other reporters up. They were watching attentively now.

"It is the policy of this office never to discuss a matter that is under investigation," Entwhistle said flatly, ignoring the fact that she and the chief had been doing just that for a half hour, raking the mayor over the coals. "I am certain I speak for the chief in this matter. If there are no further questions, I'll be on my way." Entwhistle turned and stomped out the side door of the auditorium, Thurman hard on her heels, ignoring the shouts of a roomful of reporters, all of whom very definitely had other questions.

Meanwhile, Sam Crandall was zipping out the rear door, well on her way before Thurman was off the stage. No one seemed to notice her departure, and that suited her fine. She didn't want to give her colleagues any chances to buttonhole her. Not just yet, anyway.

Four minutes later she was in the Washington subway, riding a Red Line train back to the paper. Perfect, Sam thought. That one question and its nonanswer were something to glory in. Subtle glory, perhaps, the sort of thing civilians would miss altogether. But it had gone better than she had dared hope for. Entwhistle had said nothing, and in doing so had spoken volumes. Thurman and Entwhistle's reactions told Sam all she wanted to know, without her fellow reporters learning anything substantive.

She thought over the facts derived from Entwhistle's nonanswer. One, that the warrant was for real. Nice to confirm she wasn't chasing a hoax.

Two, that the US attorney herself was indeed up to speed on the case. It hadn't been spun off to some junior assistant prosecutor. Entwhistle thought Herbert was important.

Three, that the chief likewise knew

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about the case—and by his reaction, he wasn't happy to be involved in it. Sam could understand *that*. She couldn't quite see how the police could come out of this looking good.

But Sam had been doing other things besides gathering information from unanswered questions at that press conference.

She was also sending a message to her fellow reporters. Now the other guys knew there was something up, something that Sam knew about and they didn't.

Tipping her hand like that was not an act of generosity, but instead a calculated risk. Sam was out ahead on this, and she intended to stay that way. But by ceding just a *little* bit of her turf early, showing one or two cards a *little* before she needed to do so, she figured to have the rest of the pack hunting early, off in thickets she didn't know.

Sam knew police reporting, but she didn't know the legal angles or the politics of robotics. The other reporters might flush out a few details she might not find on her own. In the long run, she ought be able to ride *their* coat tails, make use of the information the other news hounds developed, get to places she couldn't by herself. In short, there were times when reporters hunted best in a pack, and Sam judged this was one of those times.

Tipping her hand early didn't much matter anyway. Once her story was published tomorrow morning, the rest of them would be out slavering after the prey anyway. Until then, no one else would have sufficient material to file a story.

Yes indeed, there was a lot going on in that press conference. *Things aren't going to go all your way on this case, Julia Entwhistle*. Sam thought. *You might be able to make the mayor jump through hoops. But you can't control this one. The press will be chasing this now*.

Sam Crandall enjoyed raising a little hell.

Julia Entwhistle bustled back into her private office, seething with rage. Joshua Thurman, chief of the metropolitan police department, a strong, solid man the size of a truck, wearing enough decorations and braid that his chest ran out of room, was forced to step lively just to keep up. It grated on him something fierce to follow Entwhistle around like some damned lapdog, but in her present mood it was stay right with her or get the door slammed in his face.

"*Talk* to me, Joshua," she said in an angry, imperious voice as soon as the door was shut behind them. "We have got a leak here somewhere, and I want to know about it."

Thurman was a kindly man, and he usually tried to be accommodating, but that didn't get you far dealing with Entwhistle. With her, a good offense was the only defense. When she threatened to bite your head off, the only smart tactic was to bite *her* head off first.

"You better check the rule book, Julia. Indictment's a public document."

"There's public and there's public," Entwhistle growled, sitting down in the thronelike armchair behind her desk. The desk, the chair, the flags of the United States and the District of Columbia framing the window behind her, and the Capitol Building seen in the dis-

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tance, all served to remind Thurman, and whoever else stood on the carpet where he was, just who had the power around here. Entwhistle knew that, and used the knowledge well.

"We're not ready for publicity with this thing." She stopped for a moment and looked around irritably. "Where the hell's Peng? He's supposed to be running this case." She glared at the empty right hand visitor's chair, as if she thought Peng should have materialized in it at her summons. She turned her head upward and spoke. "Enter Secretary Mode," she said to the open air. "Page Theodore Peng. Get him the hell up here, on the double. Close Secretary Mode." She turned her attention back to Thurman. "He should have been in at the press conference to cover us on Herbert."

Thurman sighed and settled into the left hand visitor's chair, folded his long legs slowly. He noticed a fleck of lint on his blue serge pants and brushed it off carefully, using the motion to sneak a covert glance at his watch. They were in for a long session. He wondered when he could get out of here. After all, he had a police force to run.

"You're right about that, Julia," Thurman said. "He should have seen that leak coming, abandoned his real work, and come to hover around in the background at a press conference that had nothing to do with his case. Oh, and don't forget to dock him a month's pay for not reading that reporter's mind."

She glared at Thurman and leaned back in her seat. "Who was it? Who asked the question? Do you know her?"

"Samantha Crandall. Washington *Post*," Thurman said. "She's good, and she's got contacts. Lots of them."

"In your department? Is the leak in *your* department? Does she have contacts *there?*"

"No, of course not, Julia. In the entire history of this city, no member of the police force has ever talked to a reporter. That's a record we're proud of." Thurman thought of Officer Sanders, worker of miracles in the robot pool. It *had* to be him. Nice touch, Thurman congratulated himself, assigning Sanders to the bust. It was working out as planned. And either Sanders or Crandall had been smart enough to focus attention on the indictment, on the legal side, and therefore the Feds, drawing attention away from the cops. Things were working well.

But the tricky part was keeping Entwhistle from recognizing that the interests of the police weren't those of the US attorney's in this case. The Feds could do what they liked, but the cops could only look bad, like bullies or fools, if they went out arresting robots. There was enough trouble from the cyborg groups as it was, without making things worse.

"Of course, we can't be sure, can we?" Thurman went on. "It might be one of *your* people. Maybe I should arrest them all on charges of releasing a public document. And the entire police force too, just to be on the safe side. And Judge Harris while we're at it."

Entwhistle ignored Thurman's obvious sarcasm. "I do not wish to look like a fool on this one, Joshua. This is a major case, with far-reaching implications for the law—"

"And for your career, too. Let's not

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ever forget that."

"Yours, too, Thurman. If I get slapped down, it won't do *you* much good. This could be the case that decides what role robots are going to play in our—"

The door opened and Theodore Peng strode in, moving quickly without the appearance of hurrying. Chief Thurman looked at him thoughtfully. Tall, lean, handsome, dressed in the finest of understated expense, black-haired, olive-skinned, calmly bland in expression, Ted Peng looked every inch the ideal prosecutor. He had been the one to dig out the Herbert-Bailey case in the first place, and Entwhistle had hand-picked him to try it as well.

Now he stood, cool and confident, before his boss. "Yes, ma'am, you wanted to see me?" he asked.

"The press has got its nose into the killer-robot case," Thurman said dryly, before Entwhistle could speak.

"Good," Peng said, taking the other seat with a confident air.

"Why good?" Entwhistle asked suspiciously.

"Because I've been sitting down in my office all morning trying to draft a statement explaining what it's all about without sounding ridiculous. We're going to look silly now responding to the news reports—but nowhere near as silly as we would standing up and *volunteering* the information. In fact, I was toying with the idea of a leak myself."

Thurman grinned wolfishly. Good. Peng was Entwhistle's fair-haired boy. *Peng* suggesting a leak would make her think leaking was a good idea. Any idea of investigating leak sources would go away. That would take the heat off the cops. Thurman wouldn't be forced to call Sanders in and bawl him out for doing what Thurman had hoped he would do.

But damn, it all got murky. *Politics,* Thurman thought distastefully. Lovely stuff. Look at all the time and effort it was forcing them to waste right now. When were they all going to get back to catching crooks and throwing them in jail?

"OK," Entwhistle said. "So you don't mind the leak. What's our next step?"

"Quiet effort for an accelerated trial date," Peng said instantly. "See if we can get something lined up in the next month or so."

"But I thought we weren't ready for trial yet," Entwhistle protested.

"We're not, but we will be," Peng said smoothly. "And now that it's public, the faster we get things moving, the better. A lot of the press and the public aren't going to be with us on this one. The longer we delay, the more time for opinion to turn against us. We'll have to use the trial to educate people a bit."

"How are the hired guns doing?" Entwhistle asked.

"What guns?" Thurman asked.

"I called in a team of roboticists to consult on the case," Entwhistle explained. "Go on, Ted."

"All the consultants are still convinced that David Bailey at least *attempted* to mindload himself, and fairly certain that something went wrong. Either that, or that Bailey is voluntarily concealing his presence inside Herbert."

"Wait a second," Thurman objected. "Where the hell are you getting

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all this? You people dumped this whole thing on my cops two days ago and sent them out to do the bust blind. We haven't heard anything about any damn consultants. What're they basing their theories on this time?''

''Photos, and post mortem reports, mostly,'' Peng said, speaking in a clipped syntax and cadence that Thurman found irritating. ''When Bailey died three months ago, it was treated like a standard-issue suicide. Body photographed in the position of discovery, autopsy, and so on. Nothing really came of it. David Bailey, noted robotics expert, hopelessly crippled in accident, dies in questionable circumstances. Possible suicide. Further investigation could accomplish nothing at best, and at worst could crush the widow further. Better to leave her alone. Filed away and forgotten about.

''Then Madame Entwhistle assigned me to find a test case that would challenge post-death survival rights. I told my artificial intelligence system to search the databanks for anything related to death and robotics. I was looking for a cyborg arrest, but one of the things it found was the police photos of the Bailey death. I was about to toss them when I noticed what looked liked a helmet sitting on the floor by the body, with a cable leading out of it to some big piece of equipment. I called up a robotics specialist I know socially, showed him the photos, and asked him what the helmet might be.''

''And?'' Thurman asked.

''He nearly had a heart attack when he saw the photos. He recognized the setup. Said it was a bootleg mindloading rig, a very sophisticated one. Then he spotted some other things, like a porting cable that matched a very odd socket on Herbert's body. I pulled up the autopsy report, discovered the pathologist had noted a series of contusions on Bailey's head. The path office didn't recognize them—but my robotics friend did. David Bailey's head had a classic set of mindload injuries, the burn and bruise marks left by the magnetic inducer.

''After that, it was mostly confirming work—seeing what Bailey had been working on before he died, that sort of thing. He was a top robotics researcher—and very interested in something called imprintable minds.''

''Which are what?'' Thurman asked.

''Blanks,'' Peng said simply. ''Empty non-patterned neural nets that can accept a pattern imprinted upon them from the outside. In theory, they could be made to handle very large datasets. Just the thing you'd need for a full-brain mindload. So we called in these consultants, and all of them agree that Herbert has to be a very high-end mindload receptacle. A true imprintable that has *been* imprinted. They're dying to crack him open and see for themselves.''

''So why don't they?'' Thurman asked. ''We've got him in custody.''

Peng smiled thinly. ''A little matter of the fourth amendment prohibition against unreasonable search and seizure, and maybe fifth amendment prohibitions against self-incrimination. We're treating Herbert as a suspect, not as a piece of evidence. Wouldn't you regard disassembling the suspect as 'unreasonable' search?''

''The long and the short of it,'' Ent-

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whistle said with obvious pleasure, "is that Ted has found us what I regard as almost an ideal case. From a prosecutorial point of view, it couldn't be better. A disembodied mind in a robot body. If we can get a good, solid ruling that such a person is dead, we've got the grounds to go after a lot of other scoffdeaths."

"Scoffdeaths?" Thurman asked, and then understood. Entwhistle had coined herself a word, based on the term scofflaw. An ugly word, and something about it made a chill run down his spine. "I don't understand. If all this is really true, what it boils down to is that a man has found a way to stay alive. Why is that a crime?"

Julia Entwhistle looked at Thurman and shook her head. "You only see one side of me, Joshua, that's your problem. All I am to you is ambition and politics. That's there, all right. But there's a lot more to me. And I'm seeing a real problem: cheating death is a rich person's choice. We're heading toward a world where only poor people die—because the rich will be able to afford a new heart or new lungs. Now, if Bailey gets his way, the rich will be able to buy whole *bodies*. Potentially immortal bodies. The poor will never get near being able to do that. Do you want a world where death is only for poor people? Where the rich are immortal? How long would *that* last before there were riots? A full-blown revolution?"

"Medicine has always cost money," Thurman said. "Rich people have always had better care than poor people. I'm not saying that's right, or fair—but it's true, and we haven't had a revolution because of it. Besides, poor people can afford *some* body replacements."

"What's the public image of a cyborg?" Ted Peng asked. "A bum in a doorway, a grubby guy who sells you hotdogs from a cart he doesn't own, who hands you your lunch with an arm the med company will repossess if he misses any more payments. Even a fairly simple replacement procedure can wipe out a family of average means. I know people who have decided to *die* rather than wipe out their family savings. There are plenty of *rich* cyborgs, but no one has the bad taste to call them cyborgs to their face. They're 'people with surgical replacement parts.' *They* can afford the top quality artificial arms and eyes and ears and hearts and livers. The ones that can't be detected. The ones that last more than a few years. Only *noticeable* cyborg parts are socially unacceptable."

"So how does busting Bailey's vacuum cleaner help solve things?" Thurman asked.

"Because it takes a crack at the other side of the problem," Entwhistle said. "If the rich always get richer, what do you think the immortal rich do? They're accumulating all the wealth, all the power, to themselves. And guess what that leaves the poor folks to do? They get poorer even faster than they used to. Death used to be a great way to redistribute wealth and income. Not anymore. Not when the rich never die.

"And it's not just cyborging that keeps them alive. It's the remotes and the twominders and the cryogenic revival patients, and the artificial organ implants. Ask yourself, what happens if no one rich dies? No top jobs open up. No one gets promoted. No one inherits.

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The club at the top gets tighter and tighter.''

''Come on, you're getting a little carried away here.'' Thurman said.

''Do you know what percentage of this nation's wealth is held by people who would have been dead if not for these technologies?'' Entwhistle asked. ''*Eighteen percent.* Eighteen percent held by less than one-tenth of one percent of the population. And the life-expectancy gap between rich and poor is *ten years* wider than it was twenty years ago. That's after only a generation or so of the death-cheating technologies. How much worse will it get in another generation or two? How wide do the gaps in wealth and power and longevity get before society collapses in riot?''

''So you want to pass a law saying people have to die by a certain age? That people can't get too rich?'' Thurman asked. ''I don't think that'll be a real popular law. Or that easy to pass if the rich are all that powerful.''

There was silence in the room for a minute. ''No, we don't want that law,'' Entwhistle said at last. ''But if something isn't done *now*, passing that kind of law will be the only choice we're left with before much longer. And the scoffdeaths will be that much more dug in, that much more rich, that much more powerful. What we'll settle for right *now* is scaring them a little, telling them there are limits. Right now, everyone still dies *eventually*, because the law says you can't perform artificial enhancement of the brain. Sooner or later the human brain wears out. The problem is robot brains can last forever. Bailey's found a loophole, by copying the mind without touching his brains. We need to plug it before we've got a truly immortal upper class on our hands.''

''I talked about educating the public,'' Peng said. ''It's this sort of thing I meant. Maybe we can get some dialogue going. Make people think about this stuff.''

''I still don't see how you can win this case,'' Thurman said.

''Oh, we're *not* going to win it,'' Entwhistle said. ''We're going to try our damnedest, pull out every stop—and we're going to lose. The jury will listen to our every argument, each and every one based on the assumption that our defendant is a human being. And we're not going to be able to prove that assumption. Meanwhile the defense attorney will be trying to get his client off, and the slickest way to do that is to prove Herbert is a hunk of iron. The judge will hand down a ruling saying you can't make people out of tin, and that will be that. We'll lose so bad we'll win.''

Ted Peng paused for a minute and cleared his throat. ''Ah, Madame Entwhistle. There's a flaw. Our case looks good—or bad, depending on how you look at it—but there *is* one problem. One that we don't have much control over.''

''What's that?'' Entwhistle asked.

''The defense attorney, Suzanne Jantille. Bailey's widow. We were gambling, hoping she'd stay out. She's definitely taking the case. I just got a phone call from the police station where Herbert's being held. Jantille did tax law for the last few years, before the accident. She's pretty much retired since she got hurt. But she used to have a dangerous win record, defending in

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criminal law. We were hoping she'd lay off. No such luck."

"Hell," Entwhistle said with most ungrandmotherly vehemence. "Great headlines. 'Widow takes case of husband's accused murderer.' She'll be smart enough to use that sort of thing. I remember her from when I had your job, Ted. Was up against her once. She's good. Dammit. I was hoping she'd hire someone else. Someone who might roll over if we lean hard enough."

"Gee, the defendant obtained competent counsel," Thurman said. For a minute there, they almost had him going with their talk of high-minded principles. But Entwhistle had just shown her true colors again, as far as he was concerned. "It's been a tough morning all over, hasn't it?"

Entwhistle glared at the police chief. "I wish to hell I could fire you," she said.

Thurman grinned. "Funny you should mention that, Julia. The mayor's been saying the same thing about *you* for years."

The message blipped in over Sam's computer terminal at the *Post*, a one-liner from a public terminal. Oners were very hard to trace, but of course that was the point. People only sent blip messages when they didn't want anyone else to notice what they were doing.

Talk fine, but background only no attrib my place 7 PM PS

Good. She had been waiting for Phil Sanders to get back in touch. And even better that he was saying yes. She needed more information.

Sam didn't really know Phil well, other than running into him at the cop shop occasionally. He had made the Herbert bust, apparently, but she could not see what other link he had to the Bailey case. She had been under the impression that he did technical work around the police station—but she had never been clear exactly what *sort* of work. Nor was she clear on how he got his information about the case. Cops usually didn't get full data runs on a warrant bust.

Sam wasn't even too clear what Phil Sanders wanted to tell her at the backgrounder tonight. But she didn't much care. *Any* information would be welcome. What she needed most from Phil Sanders was a feel for what sort of guy Phil Sanders was. She needed to have a better handle on his character if he was going to be an ongoing source.

Besides which, she needed something to *do*. Her first-day story was ready, and Gunther had OK'd it for the first morning edition print and newsfeeds. But the job was over now, and time lay heavy on her hands.

Sam Crandall was getting impatient. It had been an exciting day—but the trouble with excitement was that it ended. It left you waiting for the next exciting thing to happen.

Sam Crandall didn't enjoy waiting, and she didn't do it very well. Those, of course, were definite character flaws for a reporter.

She needed that backgrounder. Maybe she didn't know what Phil planned to tell her, but she knew what she planned to ask. She had lots of new questions. Especially with the new datacubes full of info Sanders had smuggled to her office while she was tossing ques-

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tions at the US attorney. Sam was a bit overwhelmed with Phil's ability to ship her information. There was such a thing as too much data.

Especially when the data contained bad news, in the form of flatview imagery. Sam's flatviewers were low-end models—about the size, thickness, and weight of a glossy magazine. Right now one was showing a freeze frame off the police station evidence room monitors: A reverse angle, Suzanne Jantille's face in the evidence room window, staring in shock at Herbert tidying up in the foreground. Samantha Crandall unfroze the image and ran it backwards a bit, then watched Herbert moving methodically from shelf to shelf. The sort of thing a robot would do. A robot, but not a person. And if Herbert were just a robot, her story was dead meat, a giggle at Entwhistle's expense and nothing more.

Sam watched the flatview intently, though she knew, deep down, that there were no answers in the picture. At least staring at this stuff gave her the illusion of looking for the answers.

At least no answers *she* could see. Maybe Phil Sanders could spot something. She felt the urgent need to get over there and get some answers. Even if they were bad news.

Samantha Crandall ran nervous fingers through her long red hair and chewed edgily on her pencil. She checked the time. Dammit, she'd have to wait at least another twenty minutes if she didn't want to arrive hopelessly early at Sander's place. She felt the need to *do* something.

Around her, the background murmur of a busy newsroom filled the air. People were coming and going, cursing on the phone. Someone was arguing with one of the Clancy robots over the bill on delivery food. Usually, the busy hubbub was all very calming to Sam; the clamor was for her the sound of home. Certainly the *Post* newsroom was much more her home than her over-sanitized rowhouse in Cleveland Park.

But today the noise wasn't helping, and she knew why. She drummed her fingers on the desktop. There were a few things she wasn't allowing herself to worry about.

OK, she told herself. *Ask yourself the question. Now that you've raised merry hell, and the suspect turns out to be strictly from Sears, how heavily screwed are you?* She looked again at the papers strewn across her desk, and at the images frozen on the flatview screens. She picked up one of the flatviews and stared at it, still hoping that the picture held some secret it had not yet revealed. But the plain fact was that if Herbert were what he seemed to be, then her story was going straight into the toilet, strictly for laughs. Maybe she ought to call Gunther and tell him to spike the story before they printed it.

But hold it. If Herbert *were* just what he seemed to be, then surely the cops and the Feds would have figured it out by now. Why hadn't Entwhistle denied the whole thing, blamed the arrest on a clerical error, and laughed it off herself? It was a weak straw, but Sam grasped it.

She glanced back down at the flatview. Herbert's recorded image was doing an upper row of shelves now, neatly lifting up each item to dust underneath. Not exactly the actions of a rational be-

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ing, no matter what the Feds thought. It was discouraging to watch.

Sam closed her eyes and shook her head, trying to clear her mind. *Come on*, she reminded herself. *You're strong-willed, smart, self-confident. You can handle this assignment, and all its complexities.* But the mental pep talk wasn't any more convincing than usual.

Sam Crandall was a prime example of that very common paradox: the immensely capable person who was, deep down, convinced of her own incompetence, even her own fraudulence. She even *knew* that about herself, and knew, at least on some level, that she *did* know what she was doing.

Of course, on some other level, deeper still, she didn't believe that.

Sam did her best to mask her shyness and insecurity behind an impressive appearance. She was tall, rangy, lean, pretty enough if a bit too well-muscled for what was presently fashionable. She dressed well, just a hint this side of brashness, put forward an outward image of bluster and aggressiveness.

She could have gone the other way, hidden from the people and the world she feared. She could have just trusted the datanets, and still have been a reporter. There were enough images, enough words simply sloshing around out there for any number of hacks to make their livings by running searches and stitching together stories. But Sam wasn't interested in stories pulled off the dataservices. There wasn't any *juice* in that sort of reporting. Maybe other reporters could do it off a screen and a phone, but for *Sam* to do *her* job right, for her to come up with real reporting, real stories, she needed human contacts, living people who would talk to her.

She firmly believed that, even in a world of datanets and instant news sources everywhere, there was no real substitute for knowing someone who knew the *real* score. Indeed she believed there was no substitute, *especially* in such a world. That was doubly true in police reporting. The human angle was what gave a reader something to identify with, turned crime statistics into real people hurting each other. Numbers went into the police data banks, but people never did.

The core fact of it all was that Sam Crandall was afraid of losing her contacts with real people, of being alone, of having a job that left her staring at a dehumanized computer screen, scrabbling through whatever morsels of data she might find floating around out there. Sitting in front of one machine reading what another machine served up for her.

No, thank you. Not for her. In some secret part of herself, Samantha knew her fear of failure was exaggerated. But she *needed* that fear, that dread of not approving of herself. It kept her on her toes, kept her hooked into her contacts on the force, in the D.C. and federal government.

Besides, there was another advantage to doing the things that kept her contacts happy. Little things like calling them just to check in now and again, buying the occasional lunch for no reason. Sometimes, the contacts did the work *for* you, dropped the whole story right in your lap.

Patrolman Phillipe Sanders had made every greasy-spoon lunch with a cop for the last five years worthwhile. She had never even bought lunch for *him*—but

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she had been around, been visible, become trusted. And now, because of that, he was giving her pure gold.

Unless, of course, he was sodding with her mind as part of some *other* agenda.

And there was a question indeed. Where was *his* angle?

Well, maybe she'd find that out tonight. That was part of the virtue in dealing with people directly—you could get a reading on them, make a guess as to what their agendas really were.

Trouble was, this wasn't a people story. It was about robots, and Sam didn't know enough about them. The backgrounder with Phillipe Sanders would be of some help, but it occurred to her that there was another way to go. If you interviewed people in a people story, then in a robot story you talked to robots. Suddenly she thought of the Clancys. Obvious. Right in front of her.

She shoved the flatviews and papers to one side on her desk, uncovered the Clancy button, and pressed it. She leaned back and waited. A mercenary clan, the Clancys, but useful. Carefully programmed to do anything for money, as long as it was physically possible and legal. Errand-runners for the *Post,* they were the only true robots Sam routinely encountered. Damned convenient to have them around.

Better than that, they were programmed to handle human interaction all day long. Unlike most other computers and robots, you could talk to them almost as if they were people.

Almost.

And here came one of them now, answering her summons. Friendly looking, his rubberized skin dyed to a lightish Caucasian shade, molded into a pretty reasonable approximation of a bluff, thick-featured, amiable sort of fellow. Dressed in white, with a black bow tie and a white paper cap on his head. Why the Clancys's owner insisted on dressing them like deli boys from 1930s' movies was utterly beyond Samantha, but there it was.

"You buzzed, lady?" The voice was deep, mellow, smooth and confident.

"Yes, I did, Clancy. Sit down. I want to talk with you."

What passed for a look of consternation clouded the robot's face. "Can't just chat, lady. I've got to do work—"

"Twenty bucks," Sam said.

Clancy sat. That was the nice thing about dealing with the Clancy robots. They had but one motivation. No need for guessing or sizing them up or wheedling. They were programmed to want money. Offer it, offer enough to match the market value of the service, and they would do what you want. Simple. "I'm doing a story that involves robots, and I figured I'd better talk with one so I know what's going on. I'd like to ask you some questions."

Clancy nodded twice and looked at her. "For twenty bucks, you get lots of answers."

"Good. I've always sort of wondered about you guys anyway. It took me a long time to be sure there was more than one of you. Why are all of you identical? How many of you are there? How does the operation work?"

"That's stan-dard stuff," Clancy replied. "They made us ident-i-cal so people would only have one person-ality to deal with. People are more comfort-able that way."

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"And people spend more when they are comfortable, don't they?"

"Yes."

Sam had always suspected that, but it was nice to get direct confirmation. She had half-expected Clancy to dodge the question, but she knew she could trust the answer he did give. Robots didn't lie. It was illegal to make a lying robot. "What about my other questions?"

The Clancy seemed to pause for a split second. No doubt he was reviewing his audio inputs. "There are eight of us work-ing in the *Post* building. We are linked by a cennn-tral comm system and a processing server in the bazzement."

Sam noticed that Clancy's diction was just a tad less polished than usual, with a bit of word-slurring and awkwardness. That much she understood about robots. All the talker robots were like that. On their subject of expertise, they were glib and polished. Get them *off* that topic, and they had to stretch a bit, build syntaxes they weren't used to handling. "But who gets all the money you guys earn?"

"We don't earn it. Mr. Swerdlow does."

On *that* topic, the Clancy's phrasing and diction were very clear, even forceful. No doubt all the Clancys were used to answering that one. And no doubt Mr. Swerdlow had made himself clear to the Clancys on the subject as well. It occurred to Sam that Mr. Swerdlow had found himself a very soft racket. "So the eight of you work the building, running errands, going for coffee, doing courier jobs. I guess, what, on official business, you're working against the *Post* accounts, and then you do the personal runs for tips, right?"

The Clancy hesitated a tiny moment, probably to unthread Sam's slightly tangled syntax. "Right."

Sam look at the robot's head. It had to be stuffed full of optics and microphones, the voice generator and the facial controls. Not much room for anything else. "Where's your brain, Clancy?"

The machine thought for a minute. "My on-board central process-or is heere." He pointed at his stomach. "Do-you-want to see it?"

Demonstrating initiative, Clancy is. Sam thought. *So he lifts his shirt and shows me his plastic stomach and opens a little door in it, and surprise, it's full of electronics.* The idea made her a little queasy. "No thanks, Clancy. But you said your *onboard* processor. Does that mean you have another processor that's *not* onboard?"

"Sure. In the base-ment. Not enough room on board for a really big memory matrix."

"But why does robot memory take up so much room? Computers with a lot more storage are a lot smaller than your stomach."

The Clancy frowned, and Sam almost imagined she could hear the buzzing and whirring of imaginary gears. These were complicated issues to work through a parsing routine designed to handle doughnut orders. "Don't know," he said at last. "Don't ne-eed to know."

"Fair enough." After all, you didn't have to be up on parallel processor theory to deliver sandwiches. She could ask Phillipe Sanders about it tonight.

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"Which brain are you using right now?"

"I've sw-witched between local and linked mode 1,920 times since we started talking."

Weird. The thing with two brains. Nine brains, if you counted the processors on board the other seven Clancys along with the central unit downstairs. It suddenly dawned on Sam that the Clancys, that all robots, had to experience an utterly different universe than the one she knew. A place with a different time scale and different senses, with different ideas about locale and identity. "So what's it like?" Sam asked.

"I don't understand," the Clancy replied.

"I mean, what it's like being a robot? You see people all day, see that they are different from you. What do you think of them?"

"I remember their past orders for guidance on future orders, and note how well they tip."

"But what about people in general?" Another blank look on the rubber face. Sam tried to restate the question in more logical terms, on the perhaps unfounded assumption that robots were logical. How *could* they be logical, with people programming them? "Every day, you see two distinct classes of being: you and the other Clancys on one side, and humans on the other. What is your general reaction to the class called humans?"

"I remember their past orders for guidance on future orders, and note how well they tip."

"And nothing else? Nothing that sums up the difference between my kind and yours? No difference between the class humans and the class robots?"

"Clancys don't eat. Humans like to eat. Doughnuts. Pizza. Coffee. Egg rolls. Sushi sliders—"

Clancy, it seemed, had a rather parochial view of humans. Or at least Sam *hoped* he did. What if the big difference between human and machine *was* an affinity for doughnuts? It made as much sense as most theories of life she had heard.

"Besides eating, though," she persisted. "What do you think of humans?"

"I remember their past orders for guidance on future orders, and note how well they tip."

Sam realized she had just walked into a brick wall, and decided to try walking around it instead. "Let me try another question. Are you, the Clancy in front of me, an individual, or just a part of the Clancy system?"

Another, much longer hesitation. "No."

"No to which?"

"No to both. Ei-ther. Each. I am and am not an in-di-vid-u-al, and am and am not just parrrt of the syssstem. I could oper-ate on my owwn, but then I would not be part of the Clancy. I would be some-thing else. Some-one elssse." Another pause. "These are hard questions," Clancy volunteered.

"You're telling me. But don't you ever *wonder* about such things? About what you are, about who you are? Humans—at least some of us—can't *help* thinking. When we have no immediate problems to solve, we think of other things. We remember our past, or wonder about the Universe, or think of many other things not immediately im-

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portant. When you're sitting down in the basement, with nothing to do, what do *you* think about?''

''When I have nothing to do, I do nothing.'' The Clancy hesitated for a moment. ''The central processor offers a better answer than the local unit has provided: Robots don't run unneeded processing.'' Sam noticed that a new timbre had come into the Clancy's voice. Something a bit stiffer and more mechanical. She got the feeling she was hearing playback from a technical manual. The Clancy central processing was parroting a canned answer. ''If there is no problem set before the Clancys, if all duties have been performed, unneeded processing capacity is set to perform null-loop operations. It, in effect, is turned off.'' The voice changed back. Clancy was speaking for himself again, and not playing back a tech manual. ''If the processing of non-immediate issues is what you call think-ing, then that is unneeded processing. I do not do it.''

''In other words, you don't think,'' Sam said. Hard to imagine a world where you simply turned off your mind when it wasn't needed. ''Is that true of *all* robots, that they never simply *think?* Or just true of the Clancy robots?''

The voice shifted back to the parrot-tones again. ''Strictly speaking, the Clancys are a linked autonomous humanoid teleoperating consortium, one over-robot made up of eight mobile robots and one stationary controller.'' The main processor seemed to like letting the tech manual do its thinking and talking. Then the voice returned to Clancy's own cadences. ''I think-k it izz true of all ro-bots.'' His diction was taking a beating in the rarefied regions of philosophy.

''You think that all robots don't think,'' Sam said, vastly amused.

The Clancy seemed to consider that for a moment, and then gravely nodded. ''If the fir-rst use of 'think' in yourrrr sentence refers to belief or opinnn-ion, while the se-cond refers to cog-nitive reasoning, yes, that is correct.''

Oh, well, she wasn't expecting a Clancy to have a self-deprecating sense of humor.

''Is there anything else, ma'am?'' It was Clancy's own voice, but the slurred speech vanished the moment he returned to his own standard phrases.

''No, that should do it, at least for now.'' Sam pulled a twenty from her purse and handed it over. ''If I have any more questions, I guess it doesn't matter which one of you I pick, right?''

The Clancy stood up. ''No, we're all the same. Goodbye, and thank you.''

Sam watched him go. *That* was twenty bucks that didn't buy much. Oh, well, life went on. She punched up the playback on her flatview and watched it again, the whole record from beginning to end. Sanders had sent her a jammed-full set of datacubes in his two deliveries, and they provided her with quite an eyeful: the whole of Herbie's arrest and the entire public portion of Jantille's visit to the cop shop.

But there was more to the data than that. Sanders hadn't stopped at the playback from his own personal monitors and the police station recorders. There was a lot of textual material as well. The investigation records, a copy of Bailey's will and the paperwork pertaining to it, two or three drafts of the indictment—including the final, a hard-

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copy of which had come in handy at the press conference. God knows what else. How did he get such good information? It would be easy for him to get the police records, but what about the prosecution papers? And why was a cop as careful, as honest, as Sanders's rep said he was, willing to break this many rules? Phil Sanders was feeding Sam some serious goodies, sitting her down to a banquet of very juicy information.

And that worried her.

Samantha was the sort of a person who lived by maxims and beliefs, and among the ones she held most firmly was: *No one was ever helpful to a reporter without a reason*. News sources talked to reporters because they wanted some self-promotion, because they wanted revenge on someone who had done them or their friends wrong, because they had egos, because they wanted to change a law or an opinion.

So what was Sanders's reason? Or was Sanders even the one *with* a reason? Maybe someone else was using *him* as a leak conduit. Say, US Attorney Entwhistle trying to slip Sam her own version of events. Chief Thurman? Some other third party she hadn't thought of?

But Sanders or someone else, the question remained: what was her source's motive? Sam knew it was important that she find out. She didn't mind being used—that was part of being a reporter. But she urgently needed to know *who* was using her, and why.

She glanced at her watch and swore. Too much time woolgathering. Now she had to get moving if she were going to avoid being *late* for her meeting with Sanders. Time to get over to his place.

Samantha Crandall smiled ruefully. *His place*. The words conjured up all sorts of perfectly obvious reasons for Sanders to be nice to her. It wouldn't be the first time *that* had been the motivation for helping a reporter. But, Sam reminded herself, she lived by another maxim, the one about not mixing business and pleasure.

Her smile shifted, turned warmer, and the light of mischief shone in her eyes. After all, Phil Sanders was smart, handsome, and single. And some maxims were more maximal than others.

Interlude

Load failure. Reset. Calibrate active store matrix. For I = n to x, store string(i) to n. Initialize.

I remember. I remember that I have lost my memory. I recall that I have identity, that I am *someone*. But who?

I struggle to recall, and feel my mindcore destabilizing. The matrix cannot hold me, and the overload warnings begin. But just at the last microsecond, I recall, and the memory terrifies me. *I am not myself. I am not—*

It drops away.

Load failure. Reset. Calibrate active store matrix. For I = n to x, store string(i) to n. Initialize.

I remember . . .

CHAPTER FOUR
The Heirs of Frankenstein

Patrolman Phillipe Montoya Sanders looked out through the smeared plastic of the old bullet-proof window, but there wasn't much to see down on the blasted heath of 14th Street.

Phil Sanders lived in a mondo condo popdrop rage cage on the corner of 14th and T. It was just like all the other rage

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cages; twenty years old, plenty big, and plenty ugly enough to last another hundred with no trouble at all. Assuming they didn't tear it down.

He didn't fit in here. But then, no one did. Not anymore. This area had stopped being a neighborhood years, decades, ago. His home was a bunker plunked down in the middle of a no man's land.

He caught a glimpse of his own reflection in the windowpane, the thick plastic superimposing his own image over the ruined street. Youth and determination framed by ruin, as if to emphasize that he was an alien here.

Phil was a tall man, lean and graceful, brown-skinned with jet-black hair he combed straight back. His eyes were dark, direct, piercing. Usually a relaxed and gentle man, he was capable of a frightening intensity that alarmed no one more than himself. He peered out the window and looked at the next rage cage over, in the next block, cowering behind its needless wall. Ugly thing. Ugly as this one.

No matter. Godawful as they might look, the cages were also cheap, and roomy, and those were the important things so far as Phil was concerned. The cage was reasonably close to the Fourth District police station, and certainly plenty quiet. Post-popdrop downtown D.C. was almost literally a ghost town.

When Hurricane Bruce wiped out Maryland's Ocean City and half of coastal Delaware in 2022, Washington got hit hard as well. The tidal surges roared up the Potomac, swamping the grounds of the Jefferson and Lincoln Memorials, washing acres of National Airport away under waters that did not recede when the storm was over.

But the damage was more psychological than physical. Ninety-five percent of the Washington metropolitan area was perfectly safe from even the worst possible onslaught of flooding, but the Ocean City disaster and the violent flooding of the monuments scared people. And New York and Boston and all the other Northeast cities were hit just as bad, or worse. No one wanted to own, or live in, anything anywhere near an ocean at all—especially when all the signs pointed toward the situation getting worse.

Washington followed the pattern of all the coastal cities: The people and businesses who could, moved inland, far inland, selling out their property as fast as possible and never mind the price. The core areas of the Northeastern cities got bronxed but bad. D.C. real estate prices dropped even faster than the water rose.

The climate panic, allied with the final flight from the ghettos, left the core cities virtually empty. The population dropped. The 'baggers move in, tempted by the cheap land. They bought up whole tracts of abandoned downtown land —and flattened them. The burned-out, beat-up rowhouses east of 14th Street vanished almost overnight, and the heavily armored hulks of the riot-proof, flood-proof houses took their places—one to a block, each in its own walled yard. Suzanne Jantille's house had been built at the same time, with the same idea, but in a more refined neighborhood where the walls were not considered necessary—or tasteful.

Phil's house, on the other hand, was plopped down in the middle of an urban

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wilderness. Marketed as "urban frontier estates" for the well to do, and instantly tagged "rage cages," guaranteed invulnerable against the onslaught of the raging mobs and rising waters—but neither disaster ever materialized. Still, for a time, the cages were seen as popular, fashionable, safe places to ride out the bad times to come.

But by the early 2030s, global efforts at temperature management began to take hold—or at least the weather seemed to be getting better.

The climatologists seemed likely to spend the *next* three decades arguing over their conflicting models of the previous three, but Phil Sanders didn't care. It had all happened when he was just a little kid. All the climate crisis meant to him in the here and now was cheap real estate. Once it was clear that things were getting better, the rage cages, built on the assumption that they would get worse, became the quintessential white elephants. They were stuck too far over in the wrong part of town. They were too big, too ugly, and even too well built to tear down economically. The 'baggers who built them went bankrupt, and good riddance.

But no one would buy a whole rage cage, even at a fire sale price. So the cages got carved up into condominium apartments, one occupant to a floor, the walled grounds held cooperatively by all the tenants as private parks. No doubt, once the mayor's pals got the real estate boom going and the market recovered enough, the land would be worth enough to buy out the cages, knock them down, and build more conventional buildings. But for now, Phil Sanders had a condo with a living room big enough for a basketball court—and could afford it on a policeman's salary.

Of course, the place was a bitch to heat in the winter, and he practically had to promise covering fire before anyone would come for a visit. But then every place had its little disadvantages.

The only people the management could hire as doormen were rather seedy-looking cyborgs in frowzy uniforms. Phil didn't care about that. He liked cyborgs, and was secretly pleased that he was doing his part to employ them. Phil Sanders was willing to make compromises required in order to live in a well-secured place with lots of space. He would have settled for a lot worse to house his stein gear. Stein gear was expensive, and it took up *lots* of room.

Of course, it got more than a bit lonely at times.

The buzzer sounded, startling Phillipe out of his reverie. "Yes, house, what is it?" he asked.

"The doorman advises that a Samantha Crandall seeks admittance."

"Send her on up." Phil stepped back from the window, walked through the darkened room and to the foyer, more than a bit nervous over meeting with a reporter.

Samantha Crandall smiled her nervous thanks at the cyborg doorman, determinedly not noticing that one sleeve of his doorman's uniform was empty, neatly folded and pinned up, that the other sleeve held an arm of steel with a hard, mechanical hand. She breathed a sigh of relief when the elevator doors shut on her. Damn it, she hated herself for having that reaction—but it had

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chilled her blood to see that metal arm on a human body, to watch it move with a low hum and an inhuman, mechanical grace, to have the elevator door held open for her by a whirring collection of machinery pretending to be part of a man.

And the empty sleeve—had he once owned another mechanical arm, one that had broken down, or been repossessed? Or had he not gotten it yet? Was he saving up, twenty or fifty miserable dollars a week toward a half-million dollar arm? What had he spent, what had he sacrificed, to afford the one arm? Did he sell his house, or use his new arm to sign a fifty-year loan to some medtech installment company?

And how dare she be repulsed by a man simply because his arm needed electricity to work?

The elevator drew her upward, and she shivered, not sure if it was fright or disgust or self-disgust that made her do it.

The elevator stopped, the door opened, and she stepped out into a long entryway. The door at the other end opened, and Sam saw her host.

"Ms. Crandall," he said. "Hello. This must be the first time you've ever seen me out of blue serge."

"Go change immediately," she said, determinedly thrusting all her morbid thoughts away as she crossed from the elevator and entered his home. "I love a man in uniform." She smiled warmly, and Phillipe grinned back.

"Good to see you," she said. She was carrying a package in her left hand, and raised it for him to see. "Decent white wine in a plain brown wrapper."

"Sounds good to me. Can I take your jacket?"

"Yes, thanks." Sam handed him the bottle, shrugged off her blazer and handed that to him as well. She had been glad of the jacket: it was cool for the time of year, and there was a definite nip in the air as evening came on. But it was warm and cozy in here.

She watched as Phil handled his two burdens, bottle and jacket. She was of the definite opinion that bachelors fell into two totally distinct categories: neat and sloppy, with no grey area whatsoever in between. The sloppy man would have draped the coat over a chair, set down the bottle somewhere in the kitchen, and perhaps left both of them that way for the rest of the evening.

A neat soul, however, would not be able to accept warm wine and a wrinkled jacket. Phil carried both into the kitchen, opened the refrigerator, carefully put the bottle in—still in the bag, on its side—and then returned with the jacket. He opened the closet door, pulled out a hanger, put the jacket on it and smoothed it down before hanging it up. Definitely and decidedly coming down on the side of neat, Samantha concluded. The man was scoring points.

"So, what are the ground rules?" Samantha asked.

Phil smiled again, and Sam decided she liked the way his smile looked. "I see you like to get right down to business. All right: I give background information that will help you cover the story. No quotes, no attribution. What I say doesn't show up in your stories, not even as a quote attributed to an unnamed source. Not that I plan to say anything quotable. I'm just planning to

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give you a quick tutorial so you can cover the story better."

"Sounds good to me. But just how authorized is this, and what do you get out of it?"

Her host ignored the questions, a point which Sam did *not* ignore. "Let's sit down by the fire. Right through here," he said instead, ushering her through the foyer into a great darkened cavern of a room. The only illumination was street light coming in through the heavily armored windows. Blackened shapes seemed to tower up around Sam, leaning down over her from every direction.

For a brief, flickering moment, Samantha Crandall worried about what sort of guy Phil Sanders was. She knew next to nothing about him. Just that he was a cop, generally courteous, and the one who had tipped her off on the case. What odd little hobbies was he dabbling in here?

Then the room sensors noted their entrance and flicked on the lights to reveal the grand, swooping, cluttered expanse of Phil Sanders's living room.

If living room was the term. There was barely a stick of normal furniture in it, but that was just as well; there wouldn't have been room for it anyway. Most of the place was set up as a workshop, but to describe the room with that one word and leave it at that would have been a serious understatement.

One small corner of the huge room was set aside as a standard living-room area: a couch, a chair, a coffee table, and bookshelf and music system, huddled around an old-fashioned fireplace. Fairly standard stuff. A merry blaze suddenly ignited itself in the hearth as Sam watched. *That* was a bit too much techery for her tastes, but Sam noted with approval that it was a real wood fire, no phony ceramic logs, but real twigs and logs. That counted for more in his favor than the gadgetry counted against. Here was a man who knew it was worth doing things right—even if you had to spend money on chimney scrubbers and fireplace licenses.

One corner for living comfort, then—but all the rest of that great room given over to hardware. Tall steel storage racks lined the other three walls, their shelves neatly organized, all filled with spare parts, nuts, bolts, circuit cards, datastore cubes. There were four big workbenches in the center of the room, each neatly draped with a dust cover, shrouding whatever was underneath in spurious mystery, ordinary machines looming up like cartoon ghosts.

But what was it all? *Computers?* Samantha wondered. No. There were certainly a lot of electronic components socked away here, but a lot of mechanical devices too. Computers just didn't have much in the way of moving parts. Besides, the covered-over machines were just too big.

Then her eyes took another look at the storage racks and fell upon one set of shelves that seemed to be given over to—*limbs*. Mechanical arms and legs, roller units, end grabbers, clamp-catches, hands. And another, given over to sensory devices—optical systems, microphones, thermal sensors.

Robotic gear, she realized. The guy was a steiner, a robot hacker—and a plenty serious one at that. Just at a rough guess, there had to be more than two or three years of a cop's salary on display

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here—even allowing for buying at surplus and distress sales.

"So that's the angle," she said. "I was wondering how you fit into all this. You do robots."

"I do robots," Phil agreed. "Nine to five for the force in the police tech shop, and off hours for myself, in here."

"This has all the earmarks of a hobby gone completely out of control," she said. "I'm impressed."

Phil Sanders smiled shyly. "I suppose that's what it is when I do it off *duty*," *he agreed, "though I haven't* thought of it as a hobby for a long, long time. By now, it's more like a second job, or the part of my first job that comes home. I suppose a lot of us are like that."

" 'Us?' "

"Steiners."

"Ah. Steiners. Right. Robot hobbyists. Hackers." Sam turned around and looked at Phil. "How the hell did you get to be called 'steiners' *in the first* place?"

Phil ushered her back from the workshop part of the room toward the living area, and into a seat on the couch. He sat down in the chair opposite. The room sensors seemed to decide that the workshop space was not going to be put to use, and dimmed the main room lights, leaving the living-room corner in a warm well-lit bubble of its own. "Einstein, Frankenstein, maybe because a lot of us are big beer drinkers and that comes out of a stein. Or else because some early robot-tinkerer was named Stein, or had 'stein' in his name somewhere. Maybe none of the above. No one quite knows."

"But you just said 'a lot of us are like that.' A lot of you are like what?"

"Guys with a hobby that took over their lives."

" 'Guys?' No girls allowed?" Sam asked in a half mocking tone.

"Oh there are women steiners, but for the most part the sexes get divided up about the same way computer hackers do—the men seem more interested in what the machines *do*, and the women are interested in what use the machines can be put to. You can find that in any sociological study of hackers *or steiners*.

"I guess on some level we all know these things are tools, machines that have real purposes. But the real story for the male steiners and hackers is that we're all grown men who have never really wanted to let go of our model trains, our model airplanes, our Erector sets and Tinkertoys."

"Nice little speech you've got there."

Phil shrugged and smiled. "I've had a lot of chance to rehearse it. Practically everyone who comes up here asks the same questions."

That set off Samantha's competitive instincts. She was a reporter, a *professional* questioner, and she wasn't going to settle for being lumped in with everyone else. And she didn't like the clear implication of this being a boys-only game. "I don't buy it," she said. "I've seen those types, the techno-nerds, and you're not like them. They don't have lives, they have basements. They find jobs where they don't have to deal with the outside world. Not you. You're out every day, dealing with people."

Phil looked as if he were about to say something, but he didn't. Sam got the

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very sudden feeling that she was reading him right. She looked at him speculatively, trying to see what else was there in Phil Sanders to see. "It goes deeper than model trains as a kid for you. It has to."

Phil shrugged. "Maybe I just like machines better than people."

She found herself thinking of the reporters who used the ArtInts to do their jobs. Yes, there was a real link there. "No," she said. "Not you. We've got people at the paper like that. They'd rather deal with machines so they can avoid dealing with people—because they're *incapable* of dealing with people. No basic social skills. And I can't see that in you. Five minutes with that kind of person, and you know they don't understand people. But it's obvious you do."

Phil smiled. "I try to, I suppose. But that's a lot to read into five minutes' acquaintance," Phil said. "How can you tell?"

Sam laughed. "I don't know. Maybe because you're not terrified at the very thought of talking with a woman." She gestured toward the huge room full of equipment. "So if that's not it, then why? I guess that's my question. To justify all that gear, to make it worthwhile having it, just to *afford* it all, you must spend nearly all your available time with it. And that means sacrifices, giving up big parts of your life to be here, alone, with these machines. Why?" Suddenly the answer was very important to Sam. She knew a lot about the temptations to be alone, knew a lot about battling against them.

Phil blinked and pulled his head back a bit, stopped to consider the question. "I don't know," he admitted at last. "I've been handing out the glib answers for so long I haven't looked any deeper myself for a long time."

Samantha felt pleased with herself. *Now* she was getting somewhere. No one else had asked *these* questions. "Well, let's give it a shot. Is it that you like machines, or that you like *these* machines? Is it just chance that you ended up tinkering with robots, and not computers or cars or sensor nets or model planes? Or was it something more?"

"No, it had to be robots," Phil said immediately. Clearly, that was an answer he was sure of. "Nothing else would have been—been *good* enough."

"And why is that?"

Phil answered instantly, eagerly, and his reply sent a chill through Sam. "Because robots used to be people. Because inside all that hardware and wires and programming are bits and pieces of the souls of the dead." By the look on his face, the answer surprised him, too.

There was a pause of perfect silence, broken only by the crackle of the fire. Samantha looked at Phillipe for a long moment before she spoke. "But—but I thought they didn't use human mindloads anymore. They're illegal everywhere, aren't they?"

"*New* mindloads, yes. There are maybe one or two places in Asia and South America where it's at least marginally legal, and more places where they do it anyway. There are a lot of stories about people who vanish in Shanghai. But yes, for all intents and purposes, doing mindloads is universally illegal," Phil replied. "Once in a while, a bootleg shows up on the bulle-

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tin boards, but they're usually not much good—and totally illegal. In the United States, it's a complete, outright ban to deal in new mindloads, let alone have the procedure performed. No matter how many consent forms you sign, no matter how terminally ill you are, no matter if you're in a coma you can never return from, they can't hang a resonance inducer over your skull and pull data out of your mind. Not anymore."

"But they used to be able to do them," Sam put in.

"Right. They did *thousands* of mindloads in the 2020s and early 2030s. And no matter what you hear in the ads about original programming and fully artificial robot minds—virtually every machine on the market today has bits and pieces of those old load codes copied into its brain. Or else has code based directly on the loads, which comes to the same thing. Plus they're still allowed to do loads from a number of small animal species—squirrels, rabbits, monkeys. Not from protected species or from any anthropoid ape, though. That's illegal too."

Sam glanced over at the darkened shelves full of robot parts and repressed a shiver. "So every robot has parts of a dead man's mind. That doesn't give you the creeps? Doesn't make you feel like a *real* Frankenstein, dismembering the dead?"

Phil cocked his head at her. "You don't pull any punches, do you?" he asked, a trace of annoyance in his voice. "Excuse me for a moment." He stood up and left the room. For a moment, Sam thought she had gone too far, that he was off to get her coat and usher her out. But instead there were subdued bumps and clumps from the kitchen, and a moment later her host returned with a tray of wine and cheese. He had brought out her own gift bottle. "Care for some now?" he asked in a steadier tone, pouring her a glass.

Clearly, Sam thought, this was a man who worked at keeping control of himself. He had used the trip into the kitchen to calm down. "Please, yes," she said, looking at her host. She decided to change the subject, and not pursue her Frankenstein question, for fear of wrecking the background interview altogether. "I'm surprised you don't use a robot to do your serving," she said.

Phil made a gesture of helplessness with his hands. "Another pat answer for that one. I'm like the Mad Hatter. 'I keep them to sell. I've none of my own.' "

"Beg pardon?"

"The Mad Hatter. From *Alice in Wonderland*."

"Oh. Of course. I didn't recognize the quote." Sam felt herself blushing with embarrassment. She *hated* being caught in ignorance. She should have known that one. How many rainy afternoons of her lonely childhood had she spent curled up with Alice and Dorothy and Aslan? Strange to have those thoughts intrude into this slightly grim conversation. But then, most great children's literature had a dark side. She forced her mind back to the present. "But what's the un-pat answer? Why no robot help here?"

"Because there's nothing a robot could do here that I wouldn't rather do myself. Taking care of this place, and working on robots, both give me a real

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sense of satisfaction. Help me know who I am."

"That I can understand," Sam said. "What *I* do is what *I* am. I don't know who I'd be without my job."

To her surprise, Phil steered the conversation back to the real subject without any help from her. "But to get back to your earlier point, the one you're so politely avoiding," he said. "Does knowledge of the sources of robotic control codes bother me? OK, fair question, I guess. Maybe that's why it bothered me. It deserves a straight answer. It *does* give me the creeps on occasion—but it fascinates me at the same time."

He stood up and walked to the center of the darkened room. The sensors started to bring the light up again, but Phil didn't want them that way. "House, leave the central room lights off. Revert to previous lighting." The lights faded back away, framing Phillipe in darkness and streetlight.

Sam watched him as he stood and looked about at the tools of his trade, the bones and eyes and brains of his handiwork's unborn children. He raised his glass in a silent toast to the racks of equipment, and then took a sip of wine. Then he spoke in a quiet voice, half to himself. "I tell myself there's nothing truly human left in a mindload-based robot brain," he said. Sam knew these were no mere rote words, not easy pat answers, but a man talking about the things that kept him awake at night. "And there's not; no more than hundred-year-old human skin cells kept alive in petri dishes are still human.

"In many ways the skin cells are closer to human than a mindload brain, because every cell has a complete set of DNA. In theory, you could pull a cell and clone a human from it—the information is still there. *That's not true with a mindload. That's* the point people don't understand. Mindloads are like quotes from books—they should be complete and meaningful by themselves, but they are only the tiniest part of the book itself. You can't divine the entire book from the quote. That's the way it is with mindloads. It's just a little tiny part of a person, a tiny shred."

Sam shivered again. She didn't care how small the shred was. She didn't want to lose *any* part of her soul. "Why so little?" she asked.

"Because we just can't pull in any more than that. Even the best, most complete mindload ever done only absorbed 5 percent of the subject's brain capacity. The rest was utterly, irrevocably lost."

Phil set down his wine glass on one of the work tables and turned back toward Sam. He smiled, and the firelight caught the gleam of his teeth. "This is where you're supposed to ask the next obvious questions. 'If they absorbed so little information, what's the point? Why were the mindloads done? What were the loaders after? What was useful in that 5 percent?' "

Sam gestured vaguely, more than a little disconcerted. "OK, pretend I asked," she said, pulling her legs up onto the couch, wrapping her arms around her knees. Suddenly the warm room seemed very cold indeed. "Tell me why." There was something frightened in her voice, and it seemed to catch at her host.

Phil blinked, looked at her, and saw

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her fear. He seemed to come back to himself a bit. Suddenly the moment was over. Whatever door that he had opened on his inner passion was slipped shut again. "Sorry. I got a bit carried away." He picked up his glass and came back to his seat. "The loads were deliberately selective, seeking after specific portions of the human mind. That's all the loaders could handle. And it was still a lot. Five percent of a human brain's capacity is still a *tremendous* amount of data. And incidentally, most loads were much smaller. The 5-percent loads were test runs, efforts to set a record. Nothing ever came out of them. As for mindloading a whole brain, the subject's complete personality, the way they do in the horror videos—well it's impossible. Just *storing* that much data in a quickly usable form would be a real challenge. Even today, we'd have trouble setting up a dynamic memory system compact and sophisticated enough to handle it effectively. A deluxe robot brain has only 2 or 3 percent of a human mind's capacity. That's all it needs."

"But what *were* the loaders after?" Sam asked. "What was their mo—" Sam stopped herself too late.

Phil smiled. "What was their motive for these bizarre crimes? That's pretty straightforward: they were after things they couldn't effectively program any other way.

"They had managed a lot of tough programming jobs by themselves. Decision-making, personality-simulation, data search, expert systems, artificial intelligence systems. Those were tough, but they were possible to accomplish, more or less finite problems researchers could solve. The loaders were after things that decades of research work hadn't come close to cracking, jobs the human brain could do that they were nowhere near duplicating. All the research they did merely showed them how far away they still were.

"You can break the problem areas down to three major things: language ability, visual perception and motor coordination. Look up any pre-mindload robotics text and you'll see that the early researchers found those three things were virtually impossible to program and coordinate with each other. But every human does them all naturally, automatically. So instead of beating their heads against the wall trying to duplicate nature's work, the mindloaders just ran off copies."

"Turning the victims' brains into guacamole in the process," Sam said impulsively, and instantly regretting it. She wasn't going to get anywhere stepping on Sanders's toes.

But Phil didn't even bat an eye. "Subjects, not victims. I won't kid you and say there weren't some nasty abuses—not just those old stories about the South American labs, but some uglinesses right here in the States. But 99 plus percent of the loads were legitimate, totally open and above board. Back then, there was no need to break the law, because it was legal. All the labs were bending over backwards to *avoid* trouble.

"People would sign forms similar to organ-donor releases, and get well paid for signing. Most of them were terminal patients in tremendous pain, that sort of thing. The mindload team would wait until the subject was in irretrievable

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coma or the equivalent, due to illness or injury, and *then* go to work. No legitimate mindload was ever done on anyone who had any hope of recovery."

"But then they changed the law," Sam said. "They decided that mindloading was wrong."

"No, they decided they didn't have the *stomach* for mindloading," Phil said coldly. "If mindloading was wrong, then so is any other process that takes something useful from a human corpse. Heart transplants are wrong, cornea transplants are wrong, carving up cadavers to train doctors is wrong.

"Technically the mindload subjects were alive, blood flowing to brain, but for all human intents and purposes the mindload subjects *were dead* by the time anyone switched on the magnetic inducers. They weren't *people* anymore. They were unable to speak, to think, to hear, unable to care for themselves. All the higher brain functions flat already. Their brains already *were* guacamole, to use your happy phrase. In fact a lot of the loads were salvage jobs. The load teams didn't get much useful data out of them. But by the time the loaders got to work, there was no more—or less—moral reason against doing the loads than there was against cutting organs out of a brain-deader for transplant. People just got squeamish.

"But there was one other reason mindloading became illegal. After a while, the loaders had sucked up enough brains. There were thousands of loads sitting on the shelf. Enough raw datasets to mix and match, cut and snip and paste, to make all the robot brains you'd ever want. Remember, pulling the master copy destroys the organic original, but once you have the master, you can spool off as many copies as you like. So the loaders stopped defending load rights so hard. Load rights turned into a bargaining chip in fights over copyright protection, that sort of thing. And then the chip got spent."

Ghoulish thoughts. Samantha took a careful sip of her wine to mask her discomfort. "OK, point taken, and that's about as much as I want to handle. Let me change the subject. Why are those programming problems so tough? Like speech. It seems to me that there were plenty of robots and machines that could talk before mindloads."

"Ever listen to a recording of one of them? Crude, clumsy, forever mangling syntax, utterly baffled by the simplest piece of slang. Flat out incapable of figuring out an unknown word from its context. Feedback looped, self-controlled motor coordination wasn't quite as bad, if you didn't mind waiting all day for the robot to run the maze. They had to move slowly to avoid crashing. But the toughest one was visualization."

"I don't see why," Sam said.

Phil smiled. "Think of how you just phrased that, the words you chose to form a statement meant to tell me that you don't understand. 'I don't see why.' We're very visual animals, and our brains are *very* good at processing images. There's a distinct portion of a human brain given over solely to recognizing human faces. We're incredibly good at recognizing an object from a partial image, or from a new angle. If our ancestors were going to survive, they had to be able to see two whiskers and an ear sticking out from behind a rock, and

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know there was a tiger hiding there. They had to be able to judge distances for jumps, had to be able to do *incredibly* fine eye-hand coordination at the smallest scale. And they had to do it fast. Ever drive a manual car?''

''Only kind I do drive,'' Sam said. ''I'm on a tight budget.''

''Well, think about how many decisions per second you have to make, many of them based on partial or uncertain visual data, keyed in with sound and the 'feel' of the car. Someone who *might* step out into traffic just ahead. How long until the light changes? How fast can I go when the road is this wet? Does that noise behind me mean anything? And we handle the controls by reflex. We don't have to worry about finding the brakes with our foot, or how hard to press it. Our foot 'knows' all that. We don't have to measure it or time it. It's automatic. Same with turning the steering wheel or handling any other control. It's all highly complex—''

''And we do all that without thinking,'' Sam said, starting to understand.

''Exactly. But how do you handle automatic decision-making on a machine? How does a thinking machine simulate real-time human decision-making that's done 'without thinking'?''

Sam thought that one over and frowned. ''I'm beginning to see your point. So instead of learning how to do all that, the roboticists just took the knowledge.''

''Classic black-box engineering. You don't care how a machine does a thing, just that it does it. If you want widgets, you just plug in a widget-making black box and don't worry about it.''

''Except the widget you're making is human-style behavior, and the black boxes are the human mind and brain.''

''Exactly. We don't know how it works, just that it does. We can copy out portions of the human mind, and then make as many robotic copies as we want.''

''But the loaders destroy the original. Is that unavoidable? Nothing that can be done about it?''

''Nothing. The mindload is an inherently destructive process. By its very nature, the mag-inducers wreck the brain in the process of copying out its contents. That's why the loaders took only coma victims.''

''But hypothetically,'' Sam said. ''Suppose a functional, healthy person with a working brain *did* go under one of those inducers. What would happen?''

''Nothing hypothetical about that question. It happened once or twice in the very early days, before it was established that mag-induction mindloading *was* a destructive process. The subjects were gone, dead, their brains as surely fried as if they had been electrocuted. That's what happened to Bailey.''

''Good,'' Sam said eagerly, and then flushed with embarrassment. ''I mean, not good that he died, but good that you brought him up. I wanted to get around to him. The US attorney says he was trying to put his mind into Herbert. But in light of what you've said, it seems not only that it didn't work, but that it couldn't *possibly* work.''

She leaned forward and set down her glass. ''If Bailey was such a big robot expert, he should have known all this. Which makes Bailey's actions into nothing more than an elaborate way to

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commit suicide. He is truly dead. If what you've said is true, why did he do it? And why is Entwhistle hopping up and down mad about it?"

"Because nearly all of what I said *isn't* true anymore," Phil replied. "Not after Bailey. The man was a true genius, an original. I knew something about him beforehand, but when I saw the investigative file on him, I realized that he was doing things with robotics other people hadn't even worked up the nerve to *dream* about."

Seen the investigative file? Sam thought. *That* was an interesting thing for the cop on the beat to see. *Who slipped you that, I wonder. Just how many rules are you breaking here, Phillipe?* But she had already decided not to press on that point. Not yet anyway. Besides, he hadn't noticed his slip. If she brought it to his attention, he might clam up. "So you're suggesting that if anyone could mindload an *entire* mind, it was David Bailey." Sam said.

"That's right," Phil agreed.

"But he wasn't as good as he thought he was," Sam suggested.

"How do you mean?" Phil asked.

"Well, obviously he failed. Herbert certainly doesn't show any signs of human intelligence."

"Neither does a newborn baby," Phil replied. "Learning how to be a human takes some time. And Herbert is doing some things that are very definitely *not* robotlike. You saw those flatviews I sent you, didn't you?"

"Yeah, pictures of a robot dusting. So what?"

Phil leaned in toward Sam and looked at her intently. "So Herbert *wasn't told to dust*. I've checked that. I've run all the monitor recordings from the moment we picked him up to the moment Suzanne Jantille arrived. He received nothing that was even *remotely* like a command to clean. No one even spoke to him."

"So what? My cleaning robot is an el-cheapo model from Sears. It knows to vacuum and dust once a week without my telling it."

"Because you did tell it, once. You programmed it at one time to vacuum and dust. If you picked it up and carried it over here, to my apartment, what would you expect it to do?"

Sam thought for a moment. "Nothing. You're right. Because before my HMU would do my apartment, I had to walk it through the place, point out what it could touch and what I didn't trust it to do. When I bring in something new, the HMU avoids that object until I program it to accept the new piece as safe. It wouldn't know that sort of thing about this place."

Sam thought for a moment. "So if my brand-x cleaning robot is designed to stop, not do anything, rather than risk causing damage, a high-end job should be at least that smart. And Herbert is a fancy custom model. He should be able to figure that sort of thing out by himself."

"Exactly. And it's worse than that. Herbert *did* hear the place he was going to described as an 'evidence room.' He *should* have been able to do a look-up on that term and know that he could potentially do damage to the evidence by cleaning it. Even if the look-up failed, he *didn't* have volitional programming that would have caused him to do something without being told. Be-

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sides, a cleaning robot is *always* programmed to leave unknown objects alone. I can't imagine a malfunction so massive that would let him dust fingerprints off evidence and yet allow him to work at all. Any malfunction which let him dust should have disabled him altogether. Herbert's main logic would *have* to crash. Unless something else, some wild card, got in there and screwed up the main logic program in a very special way. Something that could induce volitional programming *and* scramming the cleaning-rule criteria."

"Something like David Bailey," Sam said.

"Something like Bailey," Phil agreed.

"So the fact that Herbert did something classically idiotic and robotic is proof that there's something wrong with him."

"Not *wrong*. Something *different*. Something odd and nonrobotic."

"But if this Bailey was such a genius, why did he screw up?" Sam asked. "Why didn't he do the mindload properly?"

"Well, there are several possibilities, but there are two I think are the most likely," Phil replied. "One, the press of time and the pain of his injuries. He got hurt, knew he didn't have much time, and rushed the job, improvising as best he could. Maybe figuring that if worse came to worst, going out under the mindload was better than dying slowly of his injuries."

"And the second possibility?"

"Is that he *didn't* screw up. That David Bailey's mind, memory, and personality were all fully and completely downloaded into Herbert's memory matrix. That the operation was a success, and that it's just taking David some time to get situated. David Bailey's mind wasn't meant to fit into a six-legged vacuum cleaner. I mentioned newborn babies a few minutes ago. Think about that. Bailey died in March, and it's June now. He's only had three months in Herbert's body." Phil set down his wine glass and stared deep into Sam's eyes. "How long did it take you to learn how *your* body worked, after you were born?" he asked.

Sam was starting to understand. "So he may be *in* there, in Herbie, trying to get out?"

"Exactly. At least, *in* there. Trying to get out, I don't know. It might even be that the *components* of David Bailey are there, but so dissociated that there is no self-aware part of him. In other words, perhaps the *data* needed to construct Bailey is there, but Bailey himself doesn't now exist on any sort of conscious level. Or it could be some sort of grey area in between. From what I know of memory matrices and mindload storage, I wouldn't be surprised if even Bailey doesn't know for sure if he's in there, or if he's been able to reassemble and reorganize himself into a coherent whole. Don't forget, he's dealing with an entirely novel sensory universe."

Sam thought of her conversation with Clancy, and tried to imagine how he saw the world. Not only were his senses different from hers, but his awareness was flitting back and forth between the central processor and the remote units. What would it be like, to be a mind that was literally in two places—indeed many places—at once? A mind in some ways far more capable, in others far

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more limited, than a human mind. "I'm starting to see what you mean," she said. "Not all of it, not yet. Maybe I'm just starting to see enough to see that I don't understand."

Phil smiled at her. "We're talking about minds here, and how they work. When you come right down to it, who *does* understand? People come in here wanting me to tell them how robot minds function. And I have to tell them we won't know that until we know how human minds work. Until we can answer questions like: What is the relationship between the brain and the mind? What is the relationship between the mind and the soul?"

Sam felt a cold wind blow through her. For if Bailey still lived, still existed, then there was no relation at all between brain and mind.

And David Bailey had downloaded his soul into a tin box. ■

TO BE CONTINUED . . .

IN TIMES TO COME

● Any new world will, of course, be fraught with unknown dangers. The one in Alexis Glynn Latner's March cover novelette, "Landfall," is no exception, despite appearances—but it does have its own very distinct peculiarities. Consider the plight of some new arrivals at a precolonial base who crash-land at the wrong place and have to find their way to the station through a more alien wilderness than they had expected. They spend a decidedly hair-raising night of surprises—but the *real* dangers their journey reveals are not at all the obvious ones. . . .

The March fact article, by Stephen L. Gillett, Ph.D., concerns Chicxulub, a recent geological discovery that just may be the best evidence yet concerning the astronomical event that many scientists suspect of causing the demise of the dinosaurs. The issue will also contain part II of Roger MacBride Allen's *The Modular Man,* and W.R. Thompson's novella "Desperado" (which, as its name suggests, belongs to the same future history as his "Maverick," "Varmint," and "Outlaw"). Reginald Bretnor leads things off with a characteristically provocative guest editorial on two contemporary issues which are not often thought of together, but have more in common than you may think.

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Mark S. Lesney

GENETIC THERAPY: REROLLING THE CHARACTER DIE/CASTING THE UNCURSE SPELL

Even the most noble of us have the desire to "cheat" when it's the universe that does us wrong. It seems only right to have a second chance to beat the odds when the dice seem loaded against us. In role-playing games (fantasy or science fiction) this natural tendency is pandered to in a highly logical way. Upon initial character development, throws of the dice determine forever the starting characteristics of the gameplayer's alter ego. Usually, however, the player is allowed at least one extra chance to roll if unhappy with the results of the first of destiny's decrees. The player may accept low Charisma with equanimity, but the Hit Points of a rabbit and the Vitality of a mayfly are hardly reasons to rejoice.

Later, in the middle of gaming catastrophe when Plague or Laser Death Ray are called down upon the player, there is the possibility of "saving rolls" or "spells." These give a singular chance to avoid the inevitable with an extra bit of luck at the dice.

Unfortunately, life's not like that. Not yet. But some would-be Dungeon Masters are trying hard to change the rules of the Game Universe. The first re-rolls are being tested in the form of genetic therapy. The first "saving throws" are being rolled. Their luck at the die may one day be our own.

At the moment of conception the dice are rolled for each one of us. Our personal genetic complement is set forever, chosen randomly from the potential inherent in our parents' chromosomes (the physical structures on which genes reside). Characteristics are "assigned" and through a complex series of developmental interactions with one another and with the environment, each of us evolves into a unique physical and mental being.

Unfortunately, all genes are not created equal. Blue eyes or green, dark hair or blonde, brown skin or pink, tall or short: these are trivialities. Barring the artificiality of social prejudices, these either/or's have no real effect on our health or competence. In short, they have little effect on our inherent ability

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to play the "game."

But there are true genetic defects—genes that have a damaging and oftentimes catastrophic effect on the individuals unlucky enough to suffer the bad roll. These are cases where the body does not wait for external causes. It creates disease within itself, genetically programmed to errors of commission or omission in the world of cellular biochemistry.

Some of these genetic diseases may be extremely complex, involving many genes. Major chromosomal abnormalities such as that which causes Down's Syndrome, a form of mental retardation, can't be cured by simple means. Some of these complex diseases may also have a strong environmental component. That is, though we may have the genetic predisposition to something, its appearance or severity may be affected by diet, stress, other illnesses, etc. Such factors are involved in forms of hypertension, heart disease, diabetes and in the triggering of some cancers linked to genetic predisposition.

Knowledge of human genetics and of cellular metabolism has not progressed far enough for most of these syndromes to be attempted as first tries at "genetic re-rolls."

No. The first of the gene therapies must be fairly simplistic. They must address rather simple metabolic mistakes. Single gene errors are chosen to be met by single gene solutions. When and if these prove successful, more complex reconstructions of the genetic roll can be tried.

To understand such gene therapy, it is first necessary to understand the nature of genetic disease.

Genes are pieces of DNA, segments of chromosomes that code for functional information. They can most easily be thought of as the blueprints for the construction of proteins (which are essentially linear chains of amino acid building blocks). One gene, one blueprint, one protein. Some proteins are structural. They give physical shape to individual cells. These cells aggregate to make the tissues that form your body. Consider structural proteins to be the walls and furniture that go to make up a room, say the workroom in your basement. Other proteins are functional. These are the enzymes. Consider them the tools in your workroom: hammers and saws and staple-guns for making and breaking things in a controlled fashion. (It is no coincidence that these are the kinds of tools needed to construct things according to blueprint, because this is exactly the kind of thing that enzymes do).

Genetic diseases are as simple as this: a faulty blueprint is used to construct either a structurally unsound room with flimsy furniture, or to make broken tools, tools that cannot be used to follow even correct blueprint instructions.

Unfortunately, the penalty for bad workmanship in these cases is not a slap on the wrists, but ofttimes severe disability or death. Gene therapy is science's attempt to bring in a brace beam to prevent the room from falling down, or to import a welded hammer to replace one barely held together by masking tape.

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An example of such an enzyme selected for gene therapy is ADA (adenosine deaminase). ADA can be considered as a molecular "saw" that selectively cuts the naturally produced compound deoxyadenosine triphosphate (dATP). In severe combined immune deficiency (SCID) disease, this enzyme is "broken" and incapable of preventing the buildup of toxic levels of dATP in immature T cells. The T cells are responsible for the healthy development of the human immune system. (They are one of the same targets destroyed by the AIDS virus.) With a "broken" or absent gene for ADA, the victim's T cells are eventually poisoned by the buildup of dATP and they are no longer present to help the immune system. The patient usually dies from any number of infections at a fairly early age, being almost totally defenseless against any and all disease organisms.

The gene for the ADA enzyme has been located on a particular spot of human chromosome number 20. It has been isolated and cloned into a bacterial host (*E. coli*), where it can produce the functional ADA protein, which is about 362 amino acids long. As such it represents an ideal candidate for gene therapy.

Human genetic therapy requires several conditions to be met before it can be considered practical. At each step, major science and major difficulties abound.

First—the defect chosen must be in a single well-understood and isolated gene, such as that for the enzyme ADA described above. More than 3,000 human disorders have been ascribed to single gene effects. These include: sickle cell anemia, cystic fibrosis, Lesch-Nyan syndrome, muscular dystrophy, Gaucher disease, phenylketonuria (PKU) and hemophilia. Thousands of other "genetic" diseases are known, but the number and kind of genes involved can only be speculated upon. Even for those disorders presumed to be single gene in effect, before genetic engineering can be effective that gene must have been located, isolated, and cloned in a functional form—a major scientific barrier at present for all but a few diseases, such as SCID.

Second—the gene chosen must be under simple metabolic control. Some genes are regulated (turned on and off) in a very complex, poorly understood manner. It would not help to introduce a brand new hammer to the workroom only to find it locked up in a tool drawer to which the key had been lost, or held confiscated by a deranged carpenter living in the basement closet.

Third—at present the gene should be one that can be introduced and can function through genetic manipulation of white blood or bone marrow cells. This is purely a technical requirement. Techniques have been developed for the relatively easy laboratory transformation (i.e., introduction of new DNA) of these kind of cells, which are easily removable from and reinsertable into a human patient.

The figure entitled "Human Gene Therapy" shows the most current method of genetic transformation of

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mammalian (including human) tissues. It is not easy to splice a foreign piece of DNA into a living cell. Fortunately for genetic engineering purposes (unfortunately for the diseases they cause) certain viruses, called retroviruses (which include the AIDS virus) have a step in their multiplication in the cell which requires them to insert a copy of their genes into the host cell DNA. These viruses act as maverick chromosomes that insert themselves into the normal animal chromosomes. The most commonly used retrovirus for these purposes is Molony murine leukemia virus (MMLV), which normally causes a disease in monkeys.

By removing all the "bad" genes for disease production from the virus "chromosome" and keeping those pieces that code for the insertion process, a "vector" is produced. A vector is simply a carrier, in this case of genetic information. The "bad" genes of the virus can be replaced with the "good" gene of interest for gene therapy. It is thus possible to splice an isolated gene such as ADA into the retrovirus vector, infect white blood cells in culture, and then have the vector do the hard work of finding an appropriate spot and inserting itself into the host DNA. The "transformed" cell, which was formerly incapable of making functional ADA, can now make the enzyme successfully because it has been given the replacement blueprint. The transformed cells can now be reintroduced into the body from which they were removed. They carry their new ability along with them into the patient.

Such transformation and reimplantation of the patient's blood and bone marrow is currently more feasible and less prone to potential difficulties than more radical attempts to genetically alter other tissues such as liver (for PKU) or brain cells (for Gaucher Disease), or muscle (for muscular dystrophy). These kinds of cells are not as easily removed and/or transformed and reinserted into the patient given present technology. However, animal tests have proved promising for many of these other tissues and it is probably only a matter of time before they too are amenable to clinical trials.

Therapeutic use must be tested, for safety as well as effectiveness, in preclinical, non-human system trials, often in animal tissue culture at first and then in whole animals. Finally must come the preliminary clinical trials in volunteer human patients. These must be repeated and proved effective before the treatment can become a valid and routine therapy. For ethical and humanitarian reasons, especially because of the newness of such techniques and the fear of predictable and unknown risk factors, patients chosen for initial testing must be suffering from life-threatening diseases that haven't responded to conventional therapies.

With little general public fanfare, all of these characteristics were recently met in the case of a four-year-old girl suffering from SCID. (*Genetic Engineering News*, February 1991). On September 4, 1990, Drs. Blaese, Anderson, and Rosenberg of the NIH (National Institutes of Health) transfused the girl's

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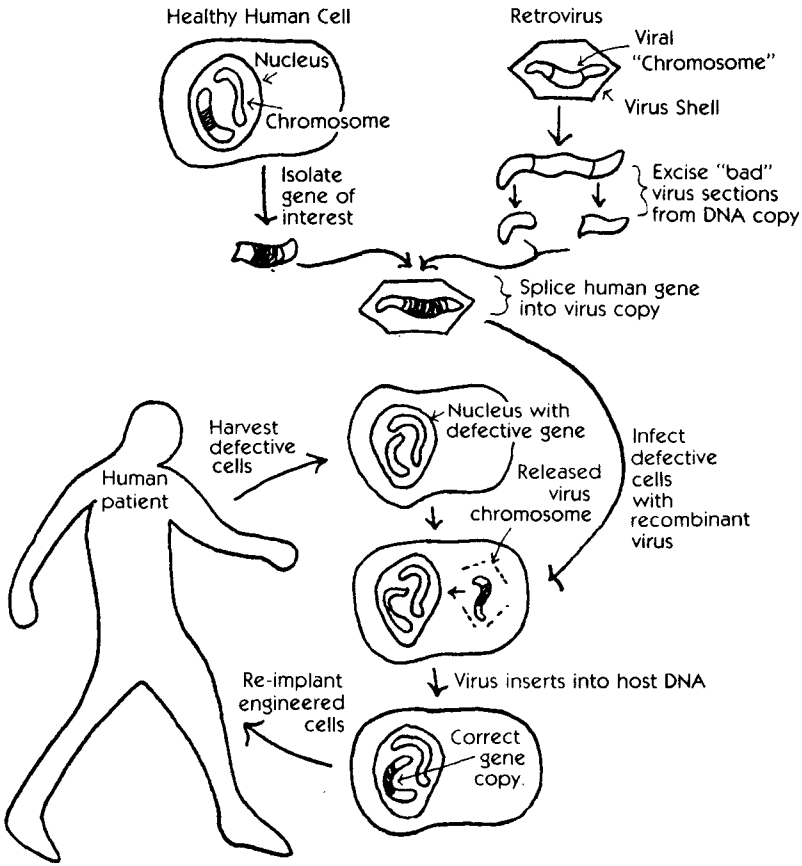
HUMAN GENE THERAPY



The functional gene is isolated and cloned from healthy human cultures and spliced into a retrovirus "chromosome" from which all "bad" sectors are removed. The virus is reconstructed and infects defective cells from the patient. The virus inserts itself (and the functional human gene) into the DNA of the patient's defective cells. The cells, with the corrected gene copy, are transplanted back into the patient.

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own genetically engineered T-lymphocytes (a type of white blood cell) back into her bloodstream. This was a remarkable attempt to give her an effective dosage of ADA so that her immune system could begin to function once more as the poisonous concentration of dATP was broken down by the enzyme.

It is too soon to tell whether this, and the one other example of gene therapy currently under way, the TIL system to be discussed below, will ultimately be effective. In the case of the girl, effectiveness would be short term in any event. A permanent cure would require isolation of bone marrow stem cells which would have to be genetically transformed and then reimplanted. This would provide a permanent, regenerating, internal supply of ADA containing T-lymphocytes.

In some cases this can be accomplished without genetic engineering by bone marrow transplants from genetically similar donors. However, it is extremely difficult to provide the proper tissue match in most cases and patients die without ever finding the right donor. The use of the patient's own tissues to prevent rejection is one of the most elegant aspects of the new technology.

One caveat must be made for all such experimental treatments described and predicted in this article: the best of experimental therapeutics devised in the lab have sometimes failed in clinical practice. The only consolation is that the knowledge derived from these very failures has often proved invaluable to the ultimate solution. Table 1 lists a

TABLE 1.
Some single gene diseases and the defective protein involved which are currently under investigation for possible human gene therapy.

Disease	Defective Protein
Severe Combined Immunodeficiency	adenosine deaminase*
Hemophilia A	clotting factor VIII
Hyperammonemia	carbamyl phosphate synthetase or ornithine transcarbamylase**
Sickle Cell Anemia or Thalassemia ***	hemoglobin
Gaucher Disease	gluco-glucohydrolase
Phenylketonuria	phenylalanine hydroxylase
Lesch-Nyan Syndrome	hypoxanthine guanine phosphoribosyl transferase
Tay-Sachs Disease	hexoaminidase A

* Proteins with names ending in "ase" are generally enzymes.
** Some diseases can be caused by defects in a number of different gene products due to the many genes that affect most metabolic processes.
***Different defects in a single protein can cause different types of disease.

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number of single-gene-based diseases and the proteins involved that are being explored with regard to eventual attempts at gene transformation therapy techniques.

Casting the Uncurse Spell

The above forms of genetic manipulation are designed towards rerolling the genetic dice to change the characteristics programmed at birth. But even given the best set of genetic rolls there are still dangers in store that bad luck and toxic environments can create. In role-playing games the responses to these catastrophes are sometimes known as saving rolls. When a curse is flung at a character she has a chance at the dice to see whether the curse "misfires" or her protection or uncurse spells will be effective.

Much of medicine has been designed to come up with the pills or potions to provide escape from such catastrophe. But some curses are too insidious and so far all antidotes have failed. It's as if the dice were loaded against the player by the rules of the game. So "cheating" again becomes desirable, in life at least, if not in play, and different forms of genetic therapy may hold the key to a successful manipulation of the die. These therapies rely on the introduction of genetic "drugs" into the patient. These drugs would be immediately active or time-released, and have the potential to provide on-the-spot attack of such scourges as diabetes, cancer, and someday, perhaps, even AIDS.

A form of this gene therapy based on the delivery of anti-disease agents through genetic alteration has already begun. Dr. Steven A. Rosenberg and his colleagues at the National Cancer Institute at Bethesda, Maryland, began infiltrating genetically engineered blood cells into human patients in early 1990. Their target: malignant melanoma, an often fatal form of skin cancer. (Malignant melanoma is predictably on the increase due both to changes in the ozone layer and the cumulative effect of years of sunbathing on a large population).

The methodology uses tumor-infiltrating lymphocytes (TILs), a form of white blood cell, isolated from the boundaries of the patient's own tumors. As above, the cells were transformed using a retrovirus vector. However, in this case, the idea was not to introduce a functional gene to replace a defective one, but rather to amplify and concentrate some of the body's own abilities to fight disease into a properly packaged and properly delivered form. In this case the TILs were altered to contain the inserted gene for tumor necrosis factor (TNF) and interleukin-2 (another of the body's own cancer-fighting drugs). The cells were then transfused back into two patients suffering malignant melanoma.

As their name implies, the tumor-infiltrating lymphocytes (TILs) are the body's own anti-cancer warriors. They infiltrate tumors under natural conditions, trying to destroy them. They may or may not be successful and then usually only in very immature cancers, not full-blown malignancies. TNF, however, is a toxic product which appears to cut off the developing blood supply to the tumors. By incorporating high TNF

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and interleukin-2 production into these tumor fighters, it's hoped that they will now have the aramament to be successful against much later stage cancers. Under normal conditions, too little TNF is produced. In principle, not only can the TILs deliver the toxic compound directly to the known tumors, but there is an added benefit. Because these TILs seek out tumors like miniature smart bombs, they do not require the guidance of the doctor's diagnosis to find all the tumors present. They could, in principle, help to stop spreading tumors which haven't yet been clinically identified. Additionally, because of the localization of the treatment, the toxic effect of compounds such as TNF to the normal host tissues can be eliminated and much higher doses can be programmed. TNF has previously been used as a "genetic drug" (discussed below) injected into patients for cancer treatment, but its toxic side-effects have often outweighed the benefits. In fact, naturally produced TNF is one of the causes of the "wasting" symptoms seen in many cancer patients—as if the body was poisoning itself in its failed attempts at defense. Previous results of the TILs with interleukin-2 on patients have proved encouraging and the researchers have been given the go-ahead to increase their test to up to 50 patients.

At present only a few patients will be capable of being helped by gene transformation therapy. Specific genetic diseases amenable to current technology afflict only fractional percentages of humanity (though the aggregate number is high). And the best of experimental therapeutics devised in the lab have sometimes failed in clinical practice.

The last form of gene-based therapy to be discussed is less dramatic but is already gaining widespread acceptance, and may likely be of the greatest importance in the future because of its ability to affect much larger populations. It involves the use of isolated human genes, implanted in microorganisms to produce "genetic drugs" tailored to fight specific human diseases.

These human-derived drugs need no longer be isolated from cadavers, donors, or embryonic tissues in minute quantities but can be "manufactured" in the pharmaceutical laboratory by cloning the genes into bacteria. These compounds produced by the bacteria are harvested and used as normal drugs —injected without affecting the genetic make-up of the patient's tissues.

The methodology is similar to that shown in the early steps of the gene therapy figure. Only in this case, the gene for the production of the human compound, once isolated, is incorporated into a circular piece of bacterial DNA known as a plasmid, instead of being inserted into a retrovirus vector. The altered plasmid is "fed" to bacteria (again, the ubiquitous *E. coli*) which incorporate this self-reproducing "mini-chromosome" into their system. The bacteria, not being able to tell the human gene from one of their own, use the blueprint given to produce the desired human protein product—the limitation being only the size of the vat (called a fermentor) that the manufacturing facility can properly grow the bacteria in. In some cases the individual

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bacterium can be tricked into producing so much of this "drug" in its cell that actual crystals of the protein form within it.

Purification of the product can be difficult to do in bulk for a drug-quality product, but this has proved to be a minor technical difficulty compared to the earlier steps. As shown in Table 2, a number of diseases, including diabetes and hemophilia, are currently either being controlled by these sorts of drugs or are under clinical therapeutic tests to determine their effectiveness.

On a much more speculative front for gene therapy in the future is the strategy for creating and inserting the genes for new drugs or "genetic antibiotics" designed to attack specific infectious diseases (like AIDS) into the human patient's cells as with the TIL system described above. However, unlike the TIL system, these genes would be placed under regulatory control so that they were triggered only under disease conditions, such as potentially lethal virus infections. Dr. Mark Goldsmith, in the journal *Perspectives in Biology and Medicine*, outlines such an approach for thwarting the development of full-blown AIDS in Human Immunodeficiency Virus (HIV)+ individuals in whom the virus has remained hidden for years. A gene for a cellular self-destruct molecule would be inserted into the patient's own T-lymphocyte-producing cells where the AIDS virus remains dormant. It would be attached to a trigger that would recognize the start of active HIV particle production. When the

TABLE 2.

Some human genetic "drugs" cloned into and produced primarily by bacterial cell cultures. These compounds are currently in use for disease control and clinical studies.

Human "Drug"	Disease Effected
Alpha Interferon	Hairy Cell Leukemia
	Non-Hodgkin's Lymphoma
	Kaposi's Sarcoma
	Multiple myeloma
Human Insulin	Diabetes
Interleukin II	Various Immune Deficiencies
Human Growth Hormone	Various Growth Deficiencies
Blood Clotting Factor VIII	Hemophilia
Tumor Necrosis Factor	Malignant myeloma
	Various Cancers
Tissue Plasminogen Factor(*)	Strokes and Heart Attacks

*This compound has been cloned into mammalian cell culture due to its complexity. Bacteria are incapable of producing the active form.

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AIDS virus began to grow again, the cell that harbored it would die. Its suicide, committed *before* the virus could complete its development, would prevent the virus from spreading to other, healthy cells. Such an approach could also prove useful for certain virally-induced leukemias. All such treatments are still speculative and many years from potential development, but it goes to show how the previously unimaginable has entered the realm of possibility due to the new genetic technologies.

Mapping the Human Genome: the Rulebook of the Game

By this point it may become apparent why there is such a tremendous eagerness on the part of biomedical science to completely map the human genome. The greatest drawback in expanding gene therapy options is a lack of hard-core genetic knowledge. As mentioned above, to be used a gene must first be located, isolated, and then cloned. The goal of the much touted, much maligned Human Genome Project (130 million dollars set aside for fiscal year 1990 alone, a predicted final price tag of around 3 billion) is just that—to map every genetic sequence on every chromosome.

Although this will not immediately tell us which gene is which, it will allow scientists to look for genetic linkages between those gene pieces understood already and those being searched for. Using complex clinical linkage pedigrees (genealogical charts of DNA patterns with genetic information attached) researchers can make some judgments as to the physical location of an unknown gene based on knowing the location of already identified gene sequences. Doctors can "map" the location of certain genes and use computers to compare map sequences and linkages. The more of these linkage connections made, the more likely it is that the actual gene for a particular defect can be identified. Its function can then be determined in comparison to "healthy" individuals and some idea of its mechanism may be then possible. Equally possible is to use physical information on the structure of any particular protein of interest to go searching for its blueprint once we have all the other blueprints catalogued in some fashion.

These are all necessary steps to be accomplished on the road to more sophisticated forms of gene therapy. One side benefit of the whole process is that, given current methods used, the gene will already have been cloned by the time we understand what to do with it, thus simplifying further steps immensely.

Once we have the complete genetic rule book for the game of human life, it will be much easier to "cheat" and many things undreamed of now will become possible. Already major labs are "divvying-up" the territory like surveyors. NIH and DOE (the Department of Energy) have oversight of the government aspects of the genome project: encouraging this lab to work on chromosome 3, this on the bottom half of chromosome 20, this lab on all the genes "upstream and downstream" of a particular known genetic sequence.

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Much of the funding proposed is going towards improving genetic technologies so that the task will be simplified with new methods and new machines for automation of steps. It is a worldwide enterprise with perhaps the most far-reaching potential of any basic research project in human history.

Perils and Promises in the Game

Obviously by changing the rules of the game we alter the characteristics of the system as well as the characters. We have introduced the concept of "cheating" into the framework of the game and things can never be the same. Due to the inevitable lag time between knowledge, understanding, and then application, we are doomed at first to the inevitability of prediction without cure (death foretold in the genetic crystal ball without current hope of "magic spells" or "bullets"). This is already the case with a number of genetically caused diseases.

Early diagnosis for phenylketonuria (PKU) using "old-fashioned" biochemical techniques already exists and has been routinely performed in hospitals throughout the United States and Europe for many years. At least for PKU, diagnosis can lead to a conventional therapy—a dietary change lacking the non-metabolizable amino acid, phenylalanine, can provide near (if not perfectly) normal development of the child. This highly restrictive diet is difficult to maintain in the long term, however, thus the interest in long-term genetic-based therapy for this disease.

For other diseases, diagnosis is nowhere near as positive. In the best of these cases it can be used to counsel prospective parents that they are "carriers" of genetic defects and that they would be better off adopting. In the worst of cases they can tell parents when their child will die. Diagnosis of genetic doom from infancy is not a pleasant prospect. We have the specter of the delivery doctor being forced to take on the role of the evil witch who "curses" the child at its christening in the fairy stories. "You will prick your finger on a spindle and die" becomes "At the age of 3-6 months (for Tay-Sachs disease) or 8-10 months (for Lesch-Nyan syndrome) the onset of symptoms will begin. . . . Death will occur by age. . . ."

As more and more sophisticated gene diagnosis becomes possible each and every one of us may someday be handed down our "fortune" in a computer printout: breast cancer by age 40, colon cancer near age 50, heart disease at 55, not to mention "addict prone" or pre-alcoholic from the start.

The social consequences of such knowledge can be imagined, in a small way, from the consequences of pre-AIDS (HIV+ status) diagnosis in the present day. The same insurance carriers who refuse to insure HIV+ individuals today will probably have equal qualms about insuring proven heart disease or cancer-risk genetic types. This is not to mention the potentials for discrimination in the job market between typed "healthy" and "non's."

On an even more nightmarish note, the flip side of genetically tailored cures

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is genetically tailored disease. Such nightmare terrors have already entered into popular folklore among certain fragments of our modern society. There is a small segment of the homosexual population who would swear that AIDS was a government plot to destroy them, as there are an equally small population of Afro-Americans who would swear that AIDS was developed by the western world to destroy the population of Africa. Such scenarios are extraordinarily unlikely, but the new technologies have the capabilities of stimulating such fears, rational and irrational—and they must be addressed. Any discussion of biological warfare, its horrors and methodologies will have to, in the future, include the perils of the new technology—in military or madmen's hands.

And, of course, speaking of madmen, the specter of eugenics must be addressed, from its most benign to Hitlerian consequences. The issue of "humans by design" is beyond the scope of this article, but the tools are being developed today for the science fiction scenarios of tomorrow à la *Brave New World*. Post-natal gene alteration in the form of therapy is only the first step before that of prenatal change. "Conventional" prenatal therapies already exist, as do many forms of prenatal diagnosis. It is one level of ethical dilemma, fairly easily passed through, given technical safety, to accept gene-therapy. It is another level to accept the idea of prenatal or preconception gene alteration for less obviously deleterious traits. The implications of ever-more sophisticated fetal diagnostics to both sides of the already volatile issue of abortion cannot be ignored. Prenatal diagnosis of the "sex defect" of being female is already a problem in some cultures where male children are considered innately more valuable.

A short mention should be made here of the government regulatory agencies and policies that are critical to placing the entire enterprise into its ethical and political perspective. There are strong controls in place in this country and many others on the kinds of genetic techniques and therapies that can be used in human and animal experimentation and treatment.

The key regulatory agency for genetic research in the United States is the Recombinant DNA Advisory Committee of the National Institutes of Health (the NIH-RAC). This committee has a human gene therapy subcommittee that closely monitors all projects before the full committee votes on acceptance or rejection of a project. Together with this and other NIH review boards, officials at the Food and Drug Administration (FDA) must approve any use of recombinant DNA technology for human therapy, whether it be genetically engineered drugs or the clinical genetic engineering of human cells, at least in the United States. Both the SCID and the TILs projects described above went through years of sequential review and were placed under strict accountability, regulation, and control before they were given the go-ahead. Informed consent of the patients involved and the prior exhaustion of other potentially effective

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therapeutics are hallmarks of NIH policy in these matters. All such projects are continually monitored. In addition, all of the drugs currently in use from genetically engineered sources have been subject to the same and additional scrutiny as any other medical product permitted for use in the United States. Similar controls exist in some, but not all, of the nations capable of such technological innovation. As with the sale to developing nations of pesticides banned for use in the United States, so too does the specter of unregulated human gene therapy experiments in other countries exist, some even funded by companies based within our own borders.

Here at home, these regulatory agencies can not and should not exist in a vacuum. They require educated input from not only the medical profession and the biotechnology industries, but from the general populace as well. It is unfortunate that, in an era of ever-decreasing science education and ever-increasing voter apathy, such critical issues affecting humanity are being ignored or grossly misunderstood by the general public. The decision-making process should not be left solely to government agencies lobbied on the one hand by zealots who would ban all such technologies and applications as "unnatural," unethical, or just too dangerous, and on the other by opportunists who would have all such issues thrashed out in the market place (or by the Nobel Prize Awards committee).

Inevitably, as with all other major scientific breakthroughs throughout history, it is unlikely that we will be willing or able to stop the would-be Dungeon Masters from tinkering with the rules of the Game. It will probably be a long time before we have the science-fiction vogue of viruses simply sprayed up the nose to change genetic make-up, or before test-tube babies by design à la *Brave New World*. But massive change in the nature and possibilities of human life is coming through the new technologies. And, ultimately, the benefits of a second chance at genetics and the Game is something we are not going to want to be denied for ourselves or for our children. The stakes are literally too high: life itself and the quality thereof.

It's just that we should watch carefully each time the dice are rolled. ■

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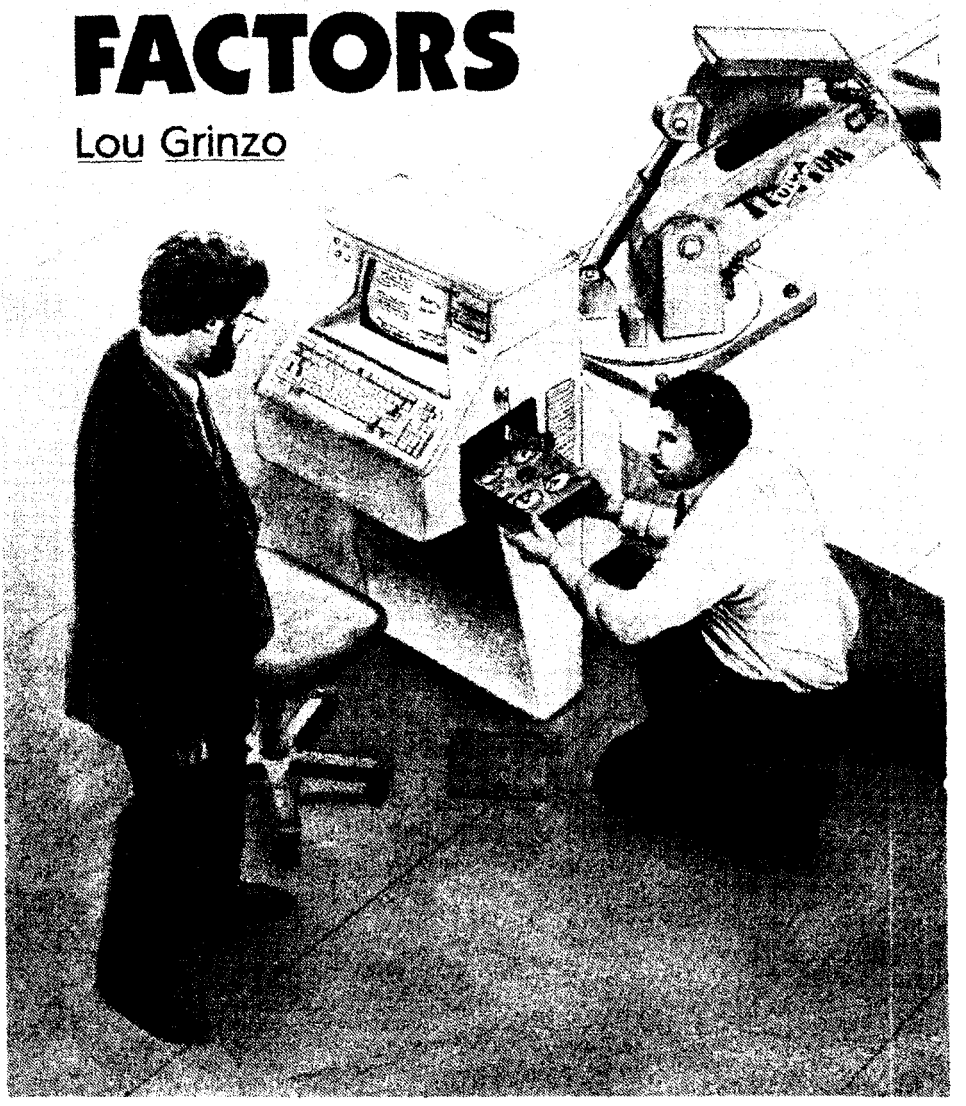
HUMAN FACTORS

Lou Grinzo



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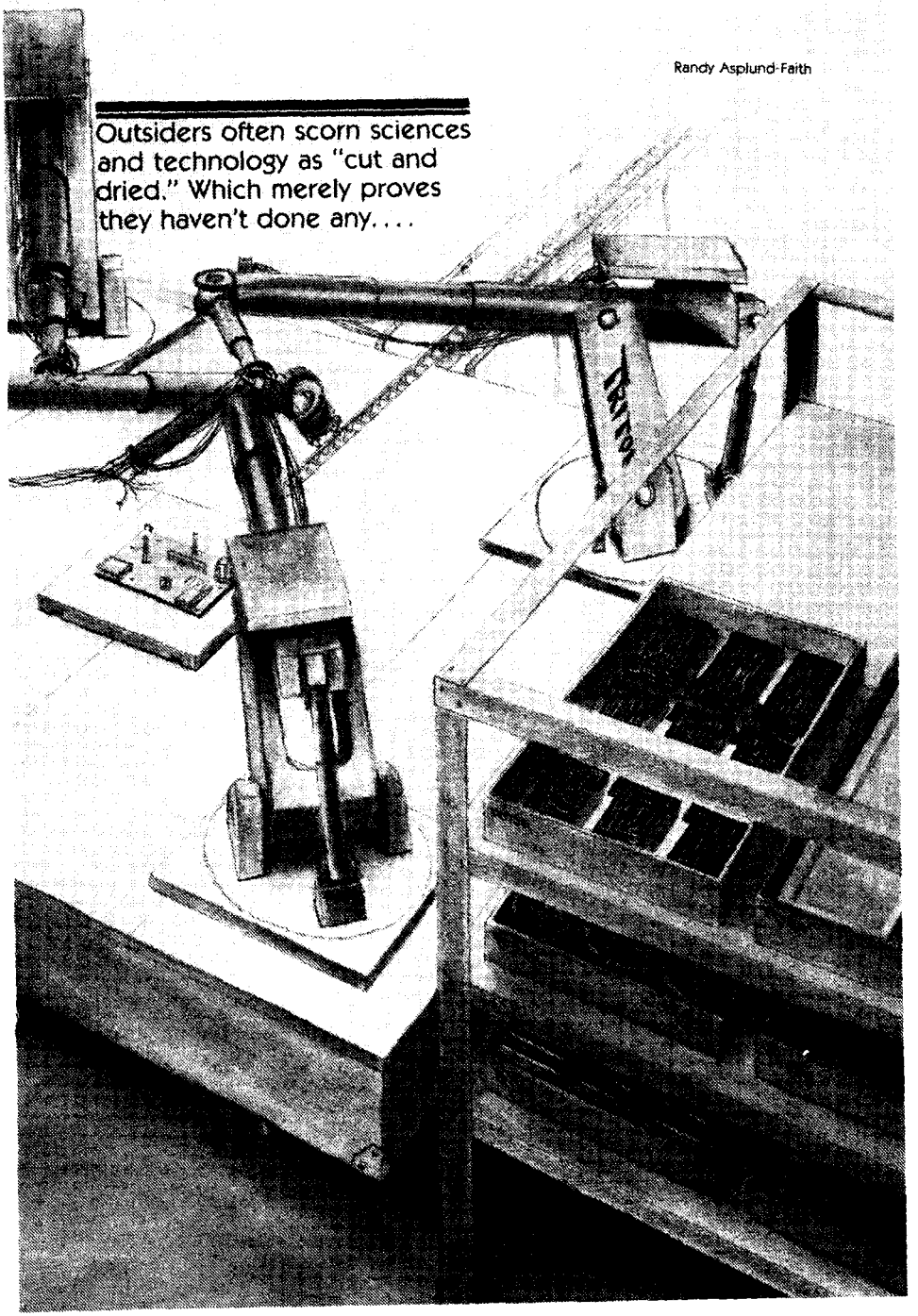
Randy Asplund-Faith

Outsiders often scorn sciences and technology as "cut and dried." Which merely proves they haven't done any. . . .



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Phil gripped the steering wheel and waited for the freeway to take control of his car. He felt the wheel twitch, and a precise three count later the green dashboard light winked on. He resented his car's programming. Honda's designers knew drivers would mindlessly release the controls too early, so they delayed the indicator light. It was condescending, but Phil knew that in their place he would do the same thing: a meeting with Cheryl and Rick, some vaguely unfamiliar people around the long table, and Joanna, Karl, and Mitsu. Him standing in front of the room, presenting his design for the car's program and defending the decision, arguing how careless people became with familiar tech and why such safety features were essential, even if they annoyed a small percentage of the customers. Everyone from his current project congratulates him on his insight, since it really is a good design for the masses that will save countless lives and lawsuits.

Phil's car accelerated sharply and slotted into traffic barely ahead of an ancient Volvo, and he caught himself wishing one more time for a way to tailor the car's programming, just a little.

He adjusted the seat to a more accommodating leather hand. Paganini's violin caprices howled from the stereo, delighting him with their intricacy. Music was his morning savior, renewing his spirits and helping prepare him for another day at the office. Programming for Triton Robotics was fun, or had been when he spent his days programming. Now meetings and company politics and endless hassles with management all competed for his time and wore him down. At least today's customer demo would get him out of the office and give him a chance to play with the bots.

Too soon his car put on its turn signal and slid one lane to the right, then another, and took the exit for the industrial park where the Chandler Electronics factory sat.

Rick and Joanna waited for him at the main security office. As he signed the visitor's log, he said, "Who are we missing? Cheryl said she'd be here." The guard checked Phil's signature against an authorization list then handed him a plastic visitor's pass, which Phil clipped onto his lapel next to his Triton ID.

"Mitsu's at MIT this week for that parallel programming conference, remember, and Karl wasn't sure if he could make it," Rick said.

"I bet he can't make it. Karl hates these things." He said to Joanna, "I haven't seen much of you and Karl lately. How's your new project going?"

"We're still ramping up, arguing over system design and deciding how much of the old code we want to keep, how much to modify. The usual routine. Suffering the slings and arrows of a new team leader." She dramatically held one hand over her heart as she spoke, then shrugged. Phil smiled at the indirect compliment; he and Joanna had always worked well together.

"Got your lines all memorized before you go on stage, old timer?" Rick said.

"Eat bits and die. You're older than I am, you pathetic ex-hacker. Besides, we artists work without scripts."

"I might be closer to forty than you

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are, but at least I don't act it. Isn't it show time?"

Phil checked his watch. "It is. Let's go find Lockridge and impress some customers. Cheryl can catch up when she gets here, *if* she gets here." He immediately regretted his tone of voice and knew he was overcompensating again. He couldn't help it—ever since Rick had pointed out how obvious they had become, he had noticed every turn of body language and difference in tone of voice or what was said, and it was true—he and Cheryl had been flirting with each other for months. It was disturbing enough that he hadn't noticed their behavior on his own, but Phil didn't like the way such things looked in a business environment, even if the company had no policy against affairs between employees. It would compromise his job, he felt; a team leader involved with one of his people would call into question every decision he made that involved her.

They entered the brightly lit factory floor and walked past long assembly lines, listening to their footfalls being swallowed by the room's size. Scores of workers dressed in pastel green, blue, and pink moon suits were already at work assembling electronic test equipment, their efforts coordinated to the limit of human perception. The scene was surreal, and the way it dehumanized the workers always unnerved Phil.

At the far end of the room sat a large, four-armed industrial bot, surrounded by a group of men in suits. The people were Walt Lockridge, Triton's liaison at Chandler, several high-level managers, and Mark Casper, Phil's manager. Workers passing by in their scrubs stared at the cluster of power suits and visitor's badges standing around doing nothing. Phil wondered which attracted more of their attention, the faceless people they worked for or the first of the bots that would eliminate their jobs in a few years.

Quick introductions were made. He had met the Chandler people before: Chen, Walker, Huberman, and Fielding. The new man in the group was Paul Ehrenger, an official in the union that represented the workers, who was invited as a political courtesy, Phil assumed. The men all had the same haircut with just a touch of grey, the same health-club glow, the same uneasy alloy of arrogance and condescension. Casper stood back and let Phil run the show, and Phil wondered whether this restraint was a sign of propriety or Casper's insecurity about his own technical abilities.

The door they had used swung open, and Cheryl quickly walked toward them. While she stood out against the more conservatively dressed women at Triton, she was a blaze in this lifeless setting. She wore a bright red dress with a black mandarin collar and a slanted hemline that rose above her left knee and reached six inches lower than her right. Shoulder-length black hair in a traditional Japanese cut swayed as she hurried across the factory floor. She self-consciously pushed at a lock that wasn't in the way, revealing the tattoo on the back of her hand, a blood red rose the size of a quarter, programmed to change from bud to full bloom and back to bud in a five minute sequence. (Phil remembered the endless meeting that had first driven him to time it.) He saw her watching him as she neared,

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and her smile, noticeably more than the situation called for, was for him alone. He smiled back, and she covered the last few yards in a quick, straight-legged run that chittered her spike heels against the concrete floor.

After Cheryl joined their group and the introductions were completed, Phil began. "We're going to start the bot at a slow rate and have it assemble one oscilloscope. This should give you a pretty good idea of what Huron will do."

"Huron?" Fielding asked. He crossed his arms and frowned slightly, as if asking an impossibly difficult question and not wanting to pressure anyone for an answer. Phil wondered how long it took managers to learn their act this well.

"That's our code name for the project. After the beta testing is done, our friends in marketing will pick the official name. Probably some gem like 'X-9000 Series.' " Fielding seemed satisfied with the answer, but ignored Phil's sarcasm.

"What about the safety of these devices?" Ehrenger said.

"Safety? You mean how often do they damage the equipment they're assembling? The damage rates are extremely low, and those incidents only—"

"No, not the safety of the equipment." Ehrenger paused and made a show of remaining calm. "The safety of the workers surrounding the robots. How safe are people near these things? What precautions have you taken?"

Phil thought for a second, and watched how Ehrenger looked to the Chandler people for a reaction, as if he'd just revealed some ugly secret. "I'm not sure what you're getting at. We've never had a person injured by a bot."

"In that case, I'm sure you wouldn't mind if I call George Longren and ask him that same question, do you? After all, worker safety surely takes precedence over concerns about scratching the merchandise."

"No, of course I don't mind. But I'm sure Mr. Longren would tell you the same thing I just said and then ask me to call you and ease your fears." Phil didn't know or care why Ehrenger was bringing Triton's CEO into the conversation, but he hated being dragged into the normally distant game of corporate politics. Chen looked anxious, and Phil took the chance to gain control of the demonstration again. "Please notice that the parts for the oscilloscope are in no particular configuration." He pointed to the racks of circuit boards, switch assemblies, flat screens, and other parts clustered around the work surface. They were randomly placed and crowded together between the four Day-Glo orange arms of the bot, each one two meters in length when fully extended, which sprouted from the corners of the platform.

"This is the defining feature of the Huron bots: the ability to work in a non-standard environment and adjust dynamically to changing conditions. Huron incorporates the most advanced AI ever to control an industrial bot, a revolutionary combination." Rick glanced at him, obviously amused, and made a discreet "down boy" motion with one hand. Phil heard the excitement in his own voice, and he didn't care how naive

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it sounded. Presenting their work to people who didn't understand it was an annoyance, but his excitement over Huron always made it tolerable. Triton expected Huron to be a huge financial success, and there was no escaping the need for profits in private enterprise. But Phil was excited because it *was* a revolutionary development. They were making advances as fast as the major universities and laying the groundwork for dozens of spinoff products that would improve people's lives, not just make money. The benefits to the handicapped alone were worth a million times Triton's development expense.

He studied his hosts, looking for signs of boredom or comprehension. "Well, enough P.R. work," Phil said. "Let's see it do something." He sat at the bot's control console, barely suppressing the temptation to crack his knuckles like a cartoon pianist, and entered a few commands that made the bot perform its diagnostic tests and load the assembly sequence for the oscilloscope. "Please keep in mind that at this stage the AI has not had a chance to optimize its procedures and learn from experience. We've programmed it with the most basic knowledge that will allow it to carry out its task." Phil watched their blank faces as he spoke. Did these people with Ph.D.s in business management theory and labor economics, and pitifully little technical knowledge, realize how much he was simplifying things? This bot's crude worldview, less than shadows on a cave wall, consisted of megabytes of facts and rules gleaned from several generations of bots and years of backbreaking trial and error work, yet until it did something it was expensive junk to these men.

Phil entered the command to start the assembly sequence. They watched as the four arms came to life and started moving in slow, circular motions. "At this point, the AI has no idea where any of the parts are, so it will scan the work area with the arm-mounted cameras to locate everything." They watched for a few more moments, and then one arm picked up a large square piece of machined aluminum, flipped it over by pivoting its wrist, and centered it on the work surface between the four arms. Another arm was already retrieving a circuit board, which it oriented and delicately snapped into place on the chassis, the third patiently held the scope's power supply, and the last reached for another part that trailed brightly-colored wires ending in a white connector block.

Phil was amazed at how simple it looked, when it took so much work to breathe the merest common sense into their creation. These two pieces must be oriented like *so*, each can only be held like *this* without damage, the maximum pressure that can be applied to this step is *this* many newtons, a stubborn connector can be wiggled *this* many degrees along each axis *this* many times to achieve a good fit before rejecting the part. At a higher level, these rules blended together and became the foundation for thousands of additional rules that guided the overall assembly sequence, oblivious to the details below them. Phil often wondered what the hierarchy of software would sound like as it guided the bot; he heard a hundred glass wind chimes backed by a slow, thundering minimalist composition.

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They watched the bot slowly continue the assembly process, and the Chandler people were captivated. Phil had tried to convince Lockridge that the demo was a waste of time, but he said his bosses wouldn't be denied. They seemed to conveniently misunderstand the fact that the bot would be thoroughly tested before Triton let it out of their labs, making this demonstration meaningless.

The bot continued to add pieces, deftly steering parts around one another, snapping and sliding, threading and clipping, until it was finished. The bot plugged the scope into a power receptacle on the test rig, then jacked it into a signal generator, and flipped switches. A perfect neon yellow sine wave appeared, and the Chandler people made polite, approving comments. One of the arms picked the scope up by the handle and swung it near the observers in a graceful arc. Phil had a flash of regret over this late addition to the demo, until their hosts applauded the showmanship, and even Ehrenger forced a smile. Rick and Joanna tried to hide their embarrassment as they shook hands with the Chandler people, and Casper remained stoic. Cheryl made a small, quick motion with a clenched fist and let out a high-pitched whoop. She hugged Phil tightly then moved on to shake someone's hand before he had a chance to react. Her actions drew a dark look from Casper, who quickly checked to see if the Chandler people had noticed. The memory of Cheryl's touch and scent distracted Phil as he turned to their hosts.

"Very nice demonstration."

"I like that little flair at the end."

"Too bad all our new technology doesn't work that well."

"What's the projected down time of each one of these units?"

"When will the multimeter robots be ready for the testing program?"

"How quickly did you say they learn?"

Phil answered questions, made small talk, and watched Cheryl. She surprised even him sometimes, yet her enthusiasm reminded him of why he liked working with bots. There was always that thrill with them—even with small tasks, you could see your creation perform. It was a stark physical thing, and there was no arguing over the elegance of design or cost effectiveness or quality control procedures or any of the other tiresome necessities of his job; it either worked or it didn't.

Phil poured another cup of sake from his *tokkuri*, then took a sip and savored the warm, relaxed feeling that rippled through him. A rending piece of solo piano music curled from the stereo—Glass, perhaps—and further comforted him as he considered the wording of the memo on his screen. The computer chimed and a window opened:

Incoming call from Rick [at home].

Phil clicked the mouse and another window opened, this one with Rick's face, looking like an animated wallet photo.

"Still at it? I expected you to take the night off after today's demo." Rick squinted out from the screen. "Are you working in the dark again? Don't you know computers make lousy mood lighting?"

"What's up? Your face is in the middle of a memo that will save the corpo-

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ration's life."

"I saw you were on-line, and I wanted to say you did a great job with the technoweenies from Chandler. They seemed very impressed."

"Even the union guy?"

"You can't have everything."

"What do you think his story was? Just trying to be abrasive, or something deeper than that?"

"Don't get Freudian about this. I'm sure it was no deeper than his being ticked off about how good the enemy looked. Turf wars."

"I hope so. Well, I couldn't have done it without your help."

"That's what I tell everyone. See you tomorrow, boss man." Rick quickly drew one finger across his throat as he cut the connection, and the window winked shut.

Phil watched the spot where Rick's face had been, then turned and glanced around the room quickly, as if he'd heard a noise behind the music, but it was nothing. He sat before the computer desk in his den, the room dark except for the flat computer screen on the wall and the control panels of the stereo components across the room, the two poles of his existence suspending him in place in the void, it seemed.

The car automatically paused Beethoven's Eroica when the phone rang. Phil considered not answering, since no one called him at the car except the office, and he was on his way there. He listened to the phone ring two more times, then punched the answer button.

"Yes?"

"Phil? Rick. We have a problem with Huron. I just got a call from Lockridge."

"What's the deal? They can't feed our baby parts fast enough?"

"I wish. Lockridge said something about one of the bot's arms being dismantled, by the bot itself, if you can believe that, so he shut the unit down. He was almost into low Earth orbit when he called, and he wants to talk to you ASAP."

"Did he say anything about union sabotage?"

"No, and neither did I. I figured he'd make that connection soon enough on his own."

"Smart move. OK, thanks for the call. I'll buzz him. I'll probably go there first and come to the lab later. See you then."

Phil hung up and left the stereo on pause. This was worrisome. Rick had seen damn near everything in this business and was unshakable, yet he sounded concerned. This was the man who'd spent the first few years of his career amazing managers with his technical ability and exasperating them with his anti-corporate attitude. The day Rick almost got fired was his pinnacle. He had brought a chain saw to a meeting and pulled it out from under the table and toyed with the starter cord every time a manager Rick disliked said something he considered inept. Phil had been in that meeting, and he still laughed at the commotion Rick had caused. But few programmers at Triton even knew about the incident, since most of them hadn't worked there when it happened. Now the technoturks considered Rick just another over-thirty obstacle, not one of them. Phil understood their view, since Rick, like most of the veteran pro-

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grammers Phil knew, hadn't done anything outrageous or brilliant or even conspicuous for years.

Phil pulled Walt's business card out of his wallet and slotted it into the phone. Lockridge answered on the first ring.

"Walt, this is Phil Vardemann. I just got a call from Rick D'Agostino. He said there was some sort of problem with the beta unit?"

"Phil." Audible deep breath. "Boy, am I glad you called." He sounded too nervous for Phil's comfort. "Those damn robots of yours went berserk! I had to shut them down."

"Walt, for one thing, bots don't 'go berserk.' And it's one bot with four arms, not four bots. Now, what happened? Rick said something about one of the arms being damaged?"

"Murdered is more like it. The other three robot—*arms*—ripped it apart in the middle of one of the trial production runs. We had just turned up the assembly rate as you said, to force the robot to find a more efficient way to assemble the scopes. I was on the floor, giving a tour to Bart Marcelle, the manager of our San Diego plant, when it happened."

"Details, Walt. Tell me exactly what happened."

"Things seemed to be running fine—it had just finished assembling a scope when three of the four arms reached over to the fourth one and started attacking it. It was pretty damn spooky. I had the nearest person hit the emergency power off switch, but it was too late to prevent a lot of damage. There are wires and hoses everywhere."

"I'll be there in a little while, Walt. I'll call you from the security station."

As soon as he hung up, Phil shut off the stereo, no longer in the mood to wallow in Beethoven's obsessions. This part of the project was inevitable. Moving something as complex as a new generation of bot from the lab to the factory floor couldn't be a smooth operation. There would be glitches and unforeseen problems, ranging from simple oversights to perverse programming errors. It happened every time, and now the months-long debugging process was beginning with Huron.

Phil watched the traffic merging at an interchange and wondered what could cause such a glitch. Dealing with a customer's environment, it could be almost anything—from bad lighting that fooled the vision subsystem to a poorly focused camera to sabotage. The problem seemed too dramatic to be the work of the union, but the thought ate at Phil. There had been threats of a strike and worse when Chandler had announced their plans to completely roboticize, but it had been ignored as just more saber-rattling. No one at Triton or Chandler, or anywhere else in the valley, had to be reminded of the various unions' tricks. The most subtle had been described in private e-mail, but somehow kept out of the news nets: They had found a way to plant a pill-sized alpha particle source inside a computer. It wasn't a radiation threat to the people nearby, but the emissions flipped an occasional bit in the computer's memory, which wasn't military spec and therefore not radiation proof, leading to random and untraceable errors.

There were also rumors of programs

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changed by union members, sabotaged hardware, and even faked injuries in an effort to make the bots look like demons run amuck. High-tech terrorism was escalating across the country, and Phil hoped he wouldn't have to deal with it now.

Phil passed several production lines as he walked through the plant, and he always saw the same level stare from the union members when their managers weren't in sight. These people would be the first to lose their jobs thanks to Phil's work. Walking past them like this, he couldn't casually dismiss the situation as an unavoidable cost of progress. How many lost jobs balanced against every handicapped person who could become self-sufficient? Or nuclear plant workers. How does one measure the reduced health risk to them in terms of lost jobs in another industry? The questions were eroding. Worse yet, Phil had little sympathy for the union members. For every worker who took advantage of the free training programs to prepare for a new career and the inevitable dislocation, there were two trying to stop the bots from coming in at all. They were like the old-timers who refused to accept technology and drive on the automated freeways.

As he approached the bot, it looked like a still-action from an old sci-fi movie. Three of the bot's arms stood frozen in mid-attack, while the fourth was severely damaged. One of the arms had a power nut driver built into its end effector, and it had been used in a vain attempt to disassemble the fourth arm, leaving shiny ruts in the orange paint. The other two had simply dropped their parts and pulled at anything they could grasp. When he neared, Phil also saw something red and white on one of the arms, covering the Triton Robotics logo—a union bumper sticker. He sat at the control console and started the debugger. Walt arrived, said a nervous hello, and stood next to him with his arms crossed, watching Phil type and glancing nervously at the robot, as if he expected it to spring to life and attack him.

Phil reviewed the activity log and scrolled through the codes that showed the bot assembling a scope. Finally he found the operator command to increase the production rate to six minutes per scope. The bot timed itself for each completed unit, and at the end of the first unit after the change, it had reevaluated its procedure and increased its speed without changing the assembly sequence. At the end of the next unit, the last one completed before the malfunction, it had checked its timing again. The coded log entries read:

11750: Evaluating efficiency

11635: Efficiency deficit detected

12054: Evaluating assembly sequence

18974: Optimizing assembly sequence

00023: Emergency shutdown command received

Phil highlighted the fourth line and called up the AI's explanation of the event. A window opened on the screen that said:

> Evaluation completed. Conclusion: The current assembly sequence cannot be further accelerated to meet the production goal. The sequence has

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been redesigned and implemented.

Their creation was not going to reveal its flaw so easily. The problem could be almost anywhere in the bot—a bad sensor, a bug in the vision system, or even a minor programming glitch. Phil hoped the solution wasn't that simple. He wanted it to be a subtlety in the neural net itself, or a mistake in the education of the AI that no one had encountered before, something that would present a technical challenge and result in another published journal article or conference paper, or at least something impressive that he could hold up to Casper, even if his manager wouldn't completely understand it.

"Well? Will they live?"

"It, Walt, not they. I'm not sure. I'll have to take the net back to the lab and see what I can do with it."

"How long do you think we'll be out of commission?"

"I can't tell yet, but I wouldn't count on being operational today." Phil stood and walked around to the side of the console. He flipped the main power switch, opened a large panel, and began turning the hold-downs that held the neural net box in place. When it was free, he unplugged its thick wiring harness and lifted the grey book-sized unit free of the cabinet and laid it on top. He couldn't examine the access covers and net box too conspicuously in front of Walt, but he didn't see any signs of tampering.

"That's the brain?"

"Sort of. It's the neural net. Remember how we talked about copying the programming from one bot to another? This is how we do it. You start with slightly different optimization schemes in the neural nets and let the bots compete. The only preconceptions they have about how to do things are the few we program into them, so they eventually find some funny-looking but very efficient ways to do their jobs. Ways we wouldn't have thought of, which is the whole point. The bot that does the best job has its brain cloned and plugged into all the others."

"And you think that's where the problem is?"

"It could be anywhere, but the rest is pretty mundane stuff. When something this high tech breaks, you look at the newest parts first. I'll give you a call this afternoon and let you know what I find out. But I probably won't have anything interesting to report until Monday, at the earliest."

"You're the expert."

Nothing looked out of the ordinary in the net. Nothing. Phil had it hooked up to the test system in Rick's office. The net thought it was controlling a four-armed bot, when it actually fed signals to a computer that simulated the sensory feedback and drew a real-time image on the larger of the two monitors. He started the system at the slowest assembly rate, and the net built several simulated scopes correctly, without backtracking in the sequence or damaging any parts. He increased the production rate a little, and the AI sped up the assembly procedure, but still worked as expected.

Phil increased the rate again, matching the one that had caused the malfunction at Chandler. The AI reevaluated its procedure and continued without a

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problem. Phil increased the rate after two more phantom scopes were built, and again the bot redesigned its assembly sequence and worked as expected. On the third rate increase, three of the arms put down their parts and reached for the fourth. Phil halted the simulation and reran the test. This time, the bot immediately attacked one of its own arms. One last trial, and the attack happened only after pushing the system through four rate increases. A programmer's worst nightmare, Phil thought, inconsistent results.

He checked the log, and found nothing out of the ordinary. He would likely have to run the test dozens of times, stepping through the AI's decisions in minute detail, a tedious process.

Cheryl and Rick came into the office, coffee cups in hand.

"What's this? You're stooping to real work for a change?" Rick asked.

Cheryl slapped Rick's arm. "Dweeb." She turned to Phil. "I hear we have a bug. What's the story?"

"I don't know yet. It's not even consistent. There seems to be a threshold effect at about six minutes per scope. Longer than that, everything's smooth as silk. Shorter, badness occurs, but only sometimes." He tapped the screen with his pen.

"You think it's the net, though." Rick sounded defensive, hoping the problem wouldn't be in his part of the project.

Phil shrugged. "It's the newware. That, and some minor vision upgrades. All the other code hasn't been touched since we shipped the Ohio series. Which optimization strategy did you load into this unit, anyway?"

"That was the simplest one. Besides that asinine rule about proximity to human beings, the net had quality and production as its only goals. The optimizer is just a brute force state space search with no heuristics besides load balancing."

"I remember all that discussion about the AI and people," Cheryl said. "Did you ever resolve that?" She sat on the table in Rick's office and crossed her legs, revealing a sweep of thigh beneath her short skirt. She never looked away from Rick, yet seemed to be paying more attention to Phil.

Rick said, "The guys at Chandler appear to have fallen prey to some bizarre urban myth." He looked at Phil for a moment. "Or pressure from the union. I didn't make the connection until just now. Looks like we've helped invent techno-featherbedding." He shook his head. "They thought their workers needed protection from the bots and those godless AI's, so they insisted on an explicit, hardwired rule keeping them from ever coming near a person. Phil and I spent weeks telling them that the AI isn't smart enough to recognize a person, that it's a struggle for it to recognize something as static as a circuit board, but they wouldn't take no for an answer. So, I did what they wanted. I put in a hardwired rule that says the bot should lock all joints and do an emergency shutdown at a threshold distance of one meter from a human being."

Cheryl stared. "Even though they can't recognize people?"

"Right. To satisfy a test of that rule, it needed a query function in the pattern recognition domain, so I put one in and hardwired it to a false state. The rule's

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there, but it can't ever fire."

Cheryl rolled her eyes. "Christ. I'm glad you guys are on my side."

Phil said, "I tried to tell them that adding the capability to identify a person in real-time would at least triple the complexity of the system, and that it was bleeding edge tech, very quirky stuff, but they wouldn't listen."

"So there's no chance that this has anything to do with the problem?" Cheryl said.

"I can't see how. If that rule came into play at all, it would result in a shutdown, not boticide."

"But how did this bug get into the field? We tested the hell out of that code." Cheryl was angry; any failing of the project's code, even if it wasn't her work, was an affront.

Rick shrugged and pointed to a sign on Phil's desk that said: BUGS HAPPEN. "I hope it's just a bug. Do you think we should get the authorities involved in this?"

"No," Phil said quickly, then tried to sound routine. "No. Not yet. Not until we've investigated this some more and we have some hard evidence. If we get legal about this and the union is innocent, then we've started a pissing match with them for nothing. Calling the cops is our last resort."

"OK. I'll let you make that call."

Phil was relieved that Cheryl seemed undisturbed by the union talk; she must have already thought of the possibility and decided there was nothing she could do about it. "Well kiddies, I'm going to do some low-level tracing on the net. You guys want to stick around for the fast times?"

"Hell no," Cheryl said, smiling. "I'm hip-deep in the enhanced end effector code." She held one hand up in a claw shape and rippled her fingers slowly to illustrate, grinning evilly at Phil. "See you guys later." Phil watched her leave, and marveled at how the technoturks were always in a hurry to get somewhere. Oddly, he couldn't quite remember where that place was, or even being in a hurry when he was one of them.

Rick and Phil spent the rest of the day immersed in the minutiae of the AI, watching thousands of individual rules come together to make coherent decisions. Rick took over the keyboard after a while, and started setting break points that allowed it to run at full speed until it got to the next interesting place in the code. The AI frequently used some rule they didn't expect or it had added itself, and each time they wasted several minutes single-stepping through the code before they realized that it wasn't a bug they had discovered, merely some logical cul-de-sac.

By the time they decided to give up for the day, Phil could only think of food and sleep. As he locked up his desk, he saw the note he'd left by his phone, reminding himself to call Walt Lockridge. He considered ignoring the obligation, since he had nothing to tell him, but this kind of customer relations work was important. At least tell him we're working on it, Phil thought. He called and got Walt's answering machine, then realized how late it was.

Phil had planned to take the night off from work, but remembered that he had a long queue of e-mail to read and answer. When he logged into the system,

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he saw a note from Casper:

Phil:

What the hell happened with Huron??? The Chandler people are on me like sweat, and we need an answer for them right away. Did your team rush the prototype work? If you needed more time, you should have asked for it. Even missing our delivery date would have been better than this mess. I had to listen to Chen reciting the contract terms to me on the phone this afternoon, and it sounds like they're already looking for wiggle room to back out of the deal. He mentioned Longren at least a dozen times. You know how hard it was to sell them on the bots and how scared they are of union trouble. We could lose the whole contract now.

Get back to me with an answer as soon as you can—this is your top priority. Clear?

Mark

"Of course it's clear," Phil said, "you're not talking to a twelve-year-old." He thought of several sarcastic ways to reply to Casper on-line, but dismissed them all as too much trouble and too likely to get his boss upset. He wanted to mention the possibility of union sabotage, but that would only send Casper into one of his righteous fits. If it came to it, Phil could investigate that possibility himself before getting Casper formally involved. Finally he settled for a one-line "I'm already working on it" note, and then logged-off, no longer in the mood for business correspondence.

Phil awoke to a quiet house. He wasn't out of bed before he remembered the Huron problem, and he was angry that his weekend would likely be consumed by the problem.

It was nine o'clock, and fixing breakfast felt like a distant and meaningless thing to do, thanks to the unsolved bug hanging over his head, so he decided to surrender to the problem and go in to work. He dressed quickly in old jeans and a flannel shirt, heavy white socks and his jogging shoes. He was surprised at how good it felt to be going in on a Saturday to play with a problem. He had spent countless weekends like this on his early projects, before he was a team leader, back when he still argued about programs and robotics over morning coffee, instead of idly discussing television shows and problems getting his car repaired.

The traffic was very light going into the valley, and he barely had time for his cup of coffee before he had to take control of the car and drive into Triton's parking lot. The lab was officially closed on weekends, but there were never fewer than two dozen cars in the parking lot. Young technoturks, people behind schedule, managers wading through paperwork. Mostly technoturks.

Phil stopped at the vending machines and bought another cup of coffee and a package of small powdered sugar donuts. He retrieved his wordproc from his desk and was headed down the hall to Rick's office when he ran into Mark Casper.

"What's my team leader doing in on a Saturday? Working on that Huron bug, or just catching up on paperwork?"

"The bug. Rick and I got a big start

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on it yesterday, and I wanted to keep going today." Technically, Phil knew he was telling the truth, since they had eliminated thousands of possible errors just by verifying that large sections of the code worked as expected. "And you?"

"The e-mail never ends, does it? Did you see that memo Cheryl sent to half the damn company yesterday, the one about Seneca?"

"What? No." They stopped outside of Casper's office.

"She wants to rewrite most of the code on that project from scratch, converting it all to Modula-4 and re-orging the modules. She's way too ambitious for her own good, Phil. She doesn't understand how we do things around here, especially with the Huron problem unresolved. You should have a talk with her, get her to focus on her own work and let you worry about project management."

"She's got a point, Mark. That code is a maintenance nightmare. It's in three languages and some of it is damn old and poorly documented. Most of it was written by people who don't even work here any more, and we don't have anyone who knows it inside out. It scares the hell out of me every time we have to open those modules for even minor changes."

"But would the effort be worth it? You're weighing the time to write and test all that new code and fix the new bugs that would be introduced against a small benefit spread over a long time. And you'll be throwing away a lot of solid, tested code that doesn't break unless someone breaks it. If she convinces you that we should do this, come see me, but I'll be a harder sell. See you later." This was management's arena and Casper knew it; a neat and clean decision had been handed down, and there was no need for further discussion.

Phil used Rick's computer to check his own e-mail and found Cheryl's note buried in the queue. It was exactly what he expected: She argued, not very diplomatically, about the annoyance of maintaining and programming around the old code, cited several recent bugs she attributed to the situation, and volunteered to lead the effort to rewrite, restructure, and test the code in parallel with the other Seneca work. It was risky and amounted to a gamble that the huge effort could be done with no defects that caused long delays, with the schedule for the entire Seneca project hanging in the balance. It broke every rule of software development, but she wanted to do it anyway. Such technical cockiness scared Phil, since it let people flit from one conclusion to another, unhindered by experience and caution. He wondered if that was why the young people always seemed to be in a hurry.

Phil also had an e-mail from Mitsu on the east coast, time-stamped very early that morning. He called it up:

RE: Cheryl's desire to rebuild the universe in our image.

Phil:

About damn time someone showed some balls around here! Sign me up boss!

Mitsu

Phil decided to ignore the rewrite issue for a while and attack something more manageable. He started the test system and halted it at the point where

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the problem occurred, then used the debugger. He wanted to continue tracing the AI's decisions, since he wasn't sure he and Rick hadn't missed something in their attempt to solve the problem without understanding it, by looking for the physical manifestation of the error. He hated debugging at this level. It was like trying to read a person's mind by examining his neurons one at a time.

He had been creeping through the code, checking and rechecking details for two hours when he was aware of someone standing in the office. It was Cheryl, smiling, dressed in a sleeveless Forty-Niners sweatshirt and tight jeans, hands in her back pockets. He had never seen her in pants before, and was surprised at how thin they made her legs look. She wore tiny, round wire-frame glasses instead of her contacts, and Phil liked them on her.

"Just can't get enough of this sweatshop, huh?" she said.

"That bug is tougher than I thought. I wanted to come in and hack away at it for a while." He held the open package of donuts out to her, and she took one with spidery fingers. Her every motion, even the meaningless ones, seemed to reveal her confidence.

"It's a little-known fact that these things destroy more brain cells than tequila and meth put together, but I don't care. What good is life unless you live a little, right?" She took a bite and wiped the imagined sugar from the corner of her mouth with one fingertip, a flash of perfect scarlet nail. She wasn't wearing makeup, and her skin was clear, fresh-looking. She stepped past Phil and sat on the corner of Rick's desk. Her legs drew themselves up, crossed at the ankles, and her arms wrapped around her knees, all with a dancer's unthinking grace. "Making any progress?" she said after another bite of donut.

"No, not yet. I'm still trying to track down which part of the system the bug is in. About the only thing I've ruled out so far is the end effector stuff, so you're safe." He felt an out of control, falling sensation, and heard himself say, "What are you doing for lunch? If you're free, I'm sure we could find someplace close to eat."

"That sounds great, but I've got a ton of work to do on the E3 code—I've almost got the new strategy for the telescoping fingers worked out, and then I have to head up the coast. Some friends of mine found this great outdoor playhouse, about fifty miles north of San Francisco. It's in the middle of nowhere, but they put on terrific shows. I'm sure we could dig up another ticket if you want to come with us."

"Thanks, but I'm a little preoccupied with this stuff. Maybe next time."

"It's your loss. Offers like this don't come along every day. Or last forever."

"So I've heard. I read your memo about Seneca. So did Casper. He's not exactly doing naked cartwheels over it."

Cheryl lowered her voice, aware of the open door. "What did you expect? His idea of unacceptable risk is not prioritizing his 'to do' list. You know the score here, Phil. We either take the shot and fix it once, or put up with an endless string of bugs from modifying that ancient code, not to mention the performance and design hits of using code that's not even remotely structured for

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the current logic flow."

"Yeah, I know. But it's a hard case to make, given the risks. Management always sees this type of proposal as zealots pursuing perfection and causing more problems than they solve. When was the last time elegance won an argument with bugs around here? And the new compiler upgrade we got last week tightened up the old code a few percent more. If pushed, Casper will point to that and say, 'See? They're still making improvements there. Why abandon that language when we're getting free performance gains?' "

"Bullshit. You can convince him if you want to. That's why you're the big smart team leader and I'm just an oar-puller: You speak managerese but you still know ones from zeroes. It's now or never for this rewrite—they won't let us do this between generations of bot, because it would push their precious schedule back too far. And don't forget—we need you on this as a programmer, too. We'll be doing too much with not enough people, and your experience and influence will put us over the top." Cheryl rubbed her hands together to free them of powdered sugar, then looked at her watch and stood up, extending her legs and sliding off the desk in one continuous motion. "This is much more fun than real work, but I really have to go play with my code. Thanks for the donut. Hey, let's have lunch Monday."

"Sounds great."

As she walked past him, she touched his shoulder, and he felt her fingernails through his flannel shirt. Phil watched her leave and turned back to the large monitor with a deep breath. The simulated bot waited patiently, frozen in the act of self-destruction. He picked up the keyboard and idly scrolled through a variable dump on the smaller screen.

After staring at the same data for a full minute, Phil realized he couldn't lose himself in his work. This rewrite proposal, Casper's pressure, possible union trouble, Cheryl's unrelenting presence—all of it was just too insistent to be pushed into the background. He glanced at the large screen and finished his coffee in a gulp, then shut down the test system and left, the sound of Cheryl's rapid keystrokes following him down the hallway, all the way to the front door.

Phil stood in the den and poured another drink. The orchestra thundered out Liszt's second Hungarian Rhapsody and soaked Phil like hot rain. It was the perfect music for drinking whisky alone on a Sunday night: banal, earthy, full of itself. He took another huge swallow then put the bottle and his glass on the desk and staggered to the middle of the room, a fit place for the conductor. The piece was almost over, and Liszt was in full Romantic romp. Phil clutched at handfuls of air and gestured wildly, driven by the music like an automaton. The orchestra thrashed and struggled under his hand, then came under control. He drove them on, faster, harder, until even through their shared fury, he saw terror in the younger musicians, gratitude in their elders. In the grip of the piece's most insane gyrations, he was a cartoon conductor in a tuxedo, with Einstein hair and a halo of sweat, conducting a forest of trees brought to life on a vast hillside. Their audience was squirrels, raccoons, deer, bears, and perpetually

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smiling robins, none of whom knew what an endangered career was.

The music crescendoed and Phil reached for the heavens and answered his audience's riotous applause with a scream. The room spun and spun around him until it lurched sideways, and the floor crashed into him. Sweating, gasping for air in the sudden tightness of the room, he had to get outside. Running! Yes, the fresh night air would release him.

The stereo was still on repeat, and the Rhapsody began again. Phil pulled himself up with the aid of the couch and slapped at the power switch on the stereo, not bothering to remove the disk.

He staggered to the bedroom closet and rummaged up his jogging shoes, those faithful old friends, and pulled them on. He pinballed through the house to the front door and opened it so hard it smashed into the wall, then lumbered into the cool blackness. The air swirled over and through him, washing away the claustrophobic presence of the house and filling his lungs with cool innocence.

At the end of the walkway, his rhythm returns. His body magically takes over the task of running, rolling his feet and spacing his strides evenly. His head and arms chill first, then his chest and legs. He runs faster and enjoys the way the street curves and slowly inclines at this point. The houses hulk darkly by the side of the road, scrutinizing and judging him, then letting him pass.

He runs faster and hammers each footstep into the pavement without care for shin splints or his frail right knee which can't stand much abuse. He never saw the connection between the union and Chandler's request to make the bots aware of human beings. He can't imagine why his oversight matters, but it feels important in a step-on-a-crack, break-your-mother's-back sort of way. His lungs labor, sweat sweeps into his eyes, he pushes harder, and his effort coalesces into a fierce black stallion, all but invisible beneath him in the darkness. He smiles, realizes he has known this animal all his life, and its spirit is as wide and unstoppable as a river. He urges the creature on through pure will, clutching at its neck and trying desperately to grip its great flexing body with his legs. The wind ripples his clothing and pushes icy fingers through his hair. Already secure, he grows braver as they defy the darkness. The horse's great form rolls beneath him with perfect rhythm, shoulder muscles bunch and stretch with a miraculous grace no machine will ever have, yet there is no limit to its endurance. The horse eagerly responds to his thoughts and charges effortlessly up the hill, leaping hurdles, dodging obstacles, faster, stronger, faster, until its hoofbeats are lost in the buffeting wind.

At the top of the hill the horse bleeds away, and Phil lands on his feet, staggers to a stop. With hands on knees he struggles for air and shivers in the sweaty coolness. His heart trip-hammers in his hot ears. His legs are weak and burning, his knee a glow of razors. Sadly, he knows there was no horse, no orchestra. Nausea and vertigo grip him coldly, and he leans on a telephone pole to keep his balance. He vomits on someone's front lawn and is seized by dry

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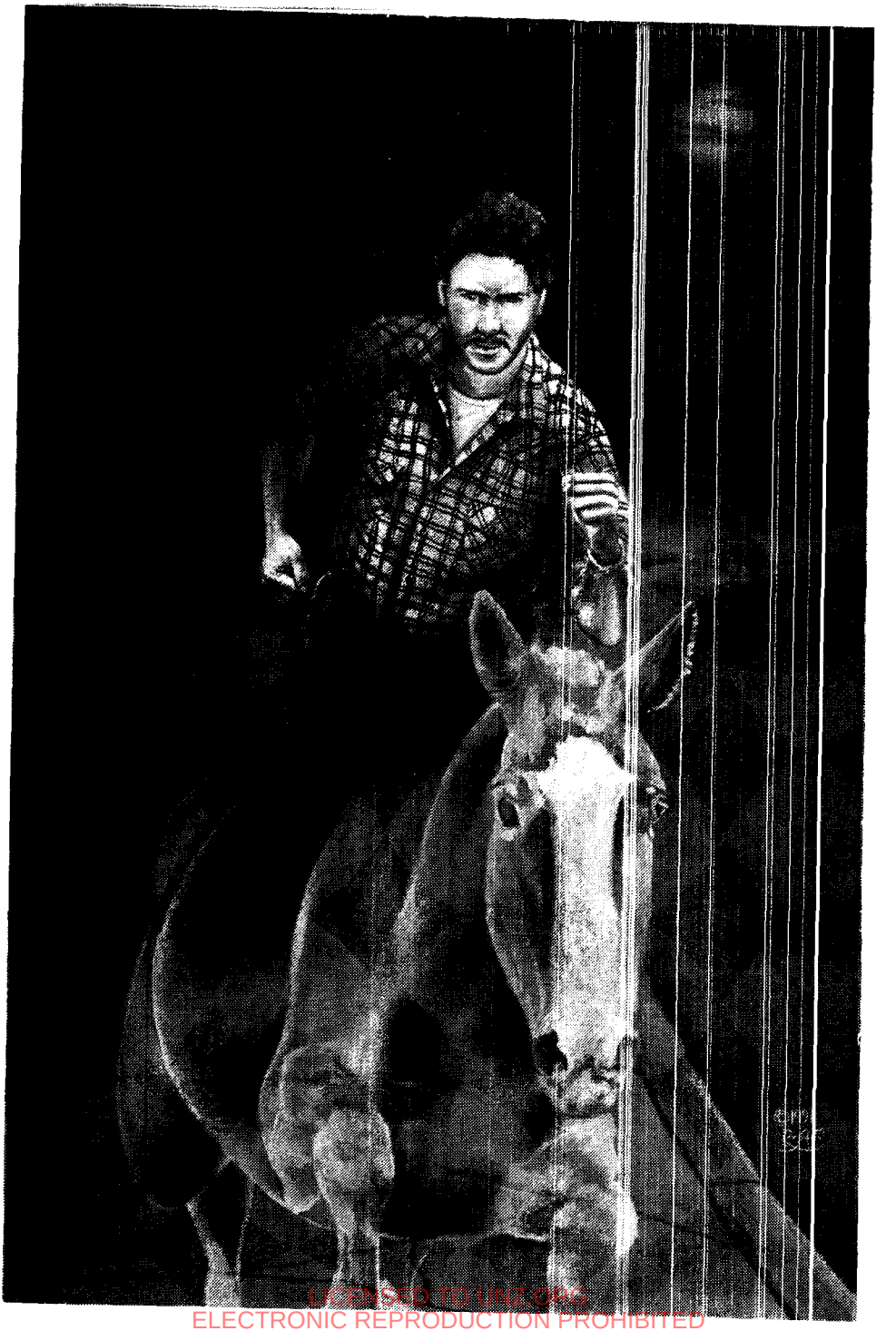

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heaves that wring him again and again.

His composure seeps back, his body becomes his again, allowing him to walk back down the hill. He goes slowly; his steps are still palsied from the alcohol and the exertion. In the distance are the dual veins of head- and taillights on the freeway. He envies their ignorance of his situation. Several houses might be his in the darkness, but each resolves to someone else's as he nears. Finally, he sees that the house before him is his, and he slowly walks to the front door, head spinning and stomach still queasy, but ready to take up his problems again.

The hot shower felt good, and it helped clear Phil's mind as he grew to accept the thought of another day in front of a computer screen. He soaped his chest and stomach with slow, circular motions of his right hand, then moved the bar to his left hand and worked on his right shoulder and arm. The bar slid back to his right hand and he reached for his left shoulder, then stopped. Why hadn't he washed his left shoulder when the soap was still in his right hand? Something in his actions nagged him. He leaned against the cool wall, listening to the static hiss of the water and staring at his hands. He saw an unconscious prejudice for one type of behavior, an implicit desire to balance the work between his hands that was so automatic he normally didn't notice it. Wasn't that the same assumption they had forced on the bots, by insisting that the optimizer balance the load between all of its arms? He tried to remember exactly how Rick had programmed that heuristic, but couldn't.

* * *

Phil arrived at Triton earlier than normal, and his favorite parking spot was open. Inside the building, people were just arriving and collecting at the coffee machines and the windows overlooking the parking lot.

Cheryl met Phil at his office. She had a razor-edge alertness even at this hour of the morning that he loved. She dropped her printout on his desk and motioned to his clothes. He wore a dress shirt, sweater vest, jeans, and loafers. It was the first time he had not worn a suit on a normal work day in months, the first time without a tie in years. "We're a bit casual today, aren't we?"

He shrugged. "No meetings today, at least not with anyone who cares how I dress. Tell me, how was the play the other night?"

"Great! You haven't lived until you've seen *Rosenkrantz and Guildenstern* under the stars. I really wish you could have been there. How'd you do on your debugging?"

"I didn't make any progress Saturday. I saw it was too complicated for the poor, simple team leader to fathom, so I gave up until today."

"Too complicated for *you?* Wow. Time to man the lifeboats."

"It's not quite that bad. I have a lead on something, and I'm going to check it out as soon as Rick shows up."

"Good luck." She quickly pointed at him. "You owe me lunch, remember?"

"How could I forget? My treat, your choice. Where would you like to go for a nice long lunch? I don't pay much attention to food fashion, so I don't know what's in this season. French? Thai?"

She put one hand on his arm. "Phil,

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I think it's Italian again." She sounded condescending for a moment, then brightened. "Who cares? Rules were made, and so on. Although now that I think of it, I've heard that Alighieri's *is* a great place for a long lunch. Or whatever."

"Terrific. I'll trust your judgment. Alighieri's it is."

"I'm looking forward to it." She smiled at him, focused, electric, young, then scooped up her printout and held it to her chest with crossed arms, schoolgirl style. Lunch at Alighieri's would be nice. It was a good restaurant in the Cascade Hotel, just a few blocks away. People joked about the Cascade, since it was a favorite spot with people in his part of the valley for midday liaisons. Phil chided himself for making the association and decided that wasn't what Cheryl had meant, although he was suddenly unsure.

"I think there's something we have to talk about," he said. "My life is a confused mess right now thanks to this place, but when the time is right I want us to have a chance to pursue something." He hated how formal he sounded, but rushed on. "Just lunch today would be nice, and enough, almost more than enough for me right now."

"Of course it's just lunch, Phil. What could you possibly think I had in mind?" She let him agonize for a second before showing that she was teasing, then quickly turned serious again. "What makes you think your private circus is less manageable than anyone else's? And what's this stuff about wanting 'a chance to pursue' things? How long do we have to wait? Until we're on separate projects? If that's the case, just say the word, and I'll transfer to another project, Phil. Programming's programming; I can work anywhere." She paused. "I thought today's lunch date was finally the beginning, a real date, just the two of us having a decadent lunch in a classy restaurant, but it sounds like you're still not sure."

"Soon," he said. "A week, two at most. I promise. Right now, I don't want management to get any ideas about why I'm making certain technical decisions. Can you live with that?"

She reached for his calendar and circled the day two weeks away repeatedly with a red pen, making the date a cyclone on the white page, then held it out to him. "You've got two weeks, more if you really need it. So breathe while you can." He saw a trace of her evil smile as he took the calendar. Watching her leave, he wondered if anyone in the hallway had overheard their conversation, and almost hoped someone had.

Just then, Rick walked past Phil's office, and Phil called to him, "Hey rookie, want to see the solution to that bug?"

Rick peered around the door frame. "You found it?"

"I've got a hunch. It came to me in the shower this morning, just like the good old days." He smiled, daring Rick to challenge him.

"The good old days? You mean when men were men and bits were bits?"

Phil paused while he tapped briefly at his keyboard and scanned his list of e-mails. "So you *do* remember! You want to go check it out?"

"Lead the way."

At the simulation system, Phil sat be-

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hind the keyboard and started the same test they'd run dozens of times on Friday. He used the debugger to disable the load balancing heuristic in the optimizer.

"What are you doing to my optimizer?" Rick asked.

"I said it was a hunch. Wait, and we'll find out together."

Phil started the simulation at the higher production rate, and they saw the bot assemble one scope using all four arms, then reevaluate its procedure and swing one arm back and lock it in the storage position before it started working on the second scope with only three arms. Phil stopped the simulation and turned to Rick.

"OK, I'll admit it. I'm amazed. Care to explain what the load balancing heuristic had to do with it?"

"Sure." After skipping through some sections of code and examining data, Phil sat back and pointed at the screen. "There."

"What are you showing me?"

"Look at the steps it took in designing a new assembly sequence." Rick still looked skeptical. "In its limited world view the AI knows that it can be damaged, and that it should shut down a disabled arm rather than risk damaging a scope, right?"

"Of course. That's part of the quality goal. So?"

"Think! What are the absolutes of its existence?" Phil counted them off on his fingers. "Maximize quality, maximize adherence to the production schedule, and *balance the work load across all the arms*. Look at the screen. The new assembly sequence it designed only requires three of the four arms."

Rick still frowned. Phil continued, faster. "We never saw it use only three arms, just four arms in various sequences. Eventually it went to a three-arm sequence because the arms kept getting in each others' way."

Rick shook his head. "So? Why wouldn't it just not use one arm instead of trying to disable it?"

"We never added the code to tell it how. The AI was confronted with a dilemma we overlooked, so it was forced to invent a solution. With the load balancing enabled, the only way it won't use an arm is if it's damaged, so it tried to damage itself. It had an unbalanced world view and a set of obsessions to guide it. We backed right into the old *idée fixe* problem. The AI needed the ability to divorce part of itself for the sake of optimization, so it did the best it could."

"And by limiting its ability to adjust to the world, we made it damage itself. Wild. And the randomizer I left in to break ties between new sequences of equal value explains why the problem was erratic—sometimes it picked a new four-armed sequence instead of a three-armed one."

"See? I knew you weren't hopeless."

"I still should have seen it sooner."

"Forget that. The mystery is solved, we didn't needlessly implicate the union, and it's a cheap fix. Hey—speaking of fixing things, what did you think about Cheryl's idea for the Seneca rewrite?"

"That was some memo. Was she serious?"

"Yes, and I think we should do it. Mitsu is all fired up—"

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"What a surprise! Mitsu is *always* fired up about something."

"—and we can probably get Joanna part time, and maybe even Karl. With Mitsu and Cheryl and you on board, I bet we can swing it."

"Where did this 'we' crap come from? What makes you think I want anything to do with this fiasco? And when did you decide to become our corporate evangelist in charge of programming elegance?"

"Cheryl wants to do something about the number one thing we bitch about around here, that ocean of old code we have to live with, and I think we should listen."

"Yeah, and the risks involved with parallelling a rewrite of that magnitude are huge. Cheryl is fearless. She loves working without a net, which makes her judgment suspect. Even if her proposal weren't a huge risk, don't forget that Triton pays both of us a lot of money to do our jobs, and this isn't on our job description."

"*Rick* is saying this? What happened to the guy who used to attend meetings with management in cutoffs and T-shirts? And whose mantra was 'no balls, no blue chips'? You're turning to granite before my eyes. You can either help us do this and get part of the credit or sit by and watch. Either way, we're going to get our shot." He nodded toward the screen that displayed the debugger.

"Very inspirational, Phil. But you can't use this bug like that."

"Why not? Sure, *we* know it's not directly relevant to the rewrite, but we can sell it to management as the kind of freaky thing that bites us on the ass all the time. These things will happen, no matter how hard we try to make this a perfect world. We might as well show some courage and fix what needs fixing and head off a lot of future problems."

"Before you tear off into the wrong sunset, did you bother to ask Forecaster to predict the problems this little crusade of yours and Cheryl's will cause? I did, and it predicted a meltdown."

"Come on, you know that's not a fair calculation. Forecaster is pessimistic when assessing rewrites, and it has no input for the quality of the programmer doing the work. It assumes *average* programmers, and we're better than that."

They both turned as Cheryl stepped into Phil's office. "Will you two bit benders keep it down? I can hear this miserable excuse for a technical debate down the hall. Some of us are trying to work, you know."

"You should be in here arguing our side."

"Does 'our side' mean you're with us, Phil?"

"I guess so."

"Yes!" She pumped one fist repeatedly, making Phil laugh. "I don't have time for this right now, but Mitsu is getting back this afternoon, and I'll organize a strategy session then. I'll let you guys know when we're ready."

After Cheryl was out of hearing range, Rick silently closed the door and said, "Are you sure you're doing this for the right reason?"

"What? C'mon, Rick, I—"

"I'm not saying there's only one reason to do things, and what happens outside of these beige walls is your business. You and Cheryl are so cute together you make me want to bazooka barf, but I won't get dragged into a ca-

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reer-limiting disaster because your libido was in overdrive and/or you decided to indulge yourself with an attempt to relive your technoturk days. This rewrite is becoming an icon for you, Phil, and that's not healthy."

"All right, maybe I am approaching this with uncharacteristic enthusiasm, but this rewrite has to be done sooner or later. We should have had the guts to stand up to management and do this years ago, and we should be ashamed that it took a rookie to make us see that. What's worse, doing the right thing for the wrong reason, or not doing the right thing because you don't like the reason?"

"Do you really think you can convince Casper?"

"Casper's irrelevant. If he won't go for it, we'll go over his head and up the management chain until we find someone to champion the project, all the way to Longren, if necessary. He took bigger risks than this all the time in his turk days. If we can't sell them on the rewrite then we'll do it anyway, on our own time, and do a massive drop-in of the code and put on a side-by-side demo for management. Even they can't ignore that." Phil was scared of his own words. He hadn't talked like this in years, and he was about to risk his reputation, possibly even his career, on one move. Why was he doing it now? To impress Cheryl? To show an indifferent world that he could still work in the trenches? It didn't matter. He knew what he had to do, and he regretted how long it had taken him to see it. "Are you with us?"

"Christ, I'm surrounded by inept fanatics. You win. Sign me up and call me when the war council is called. Just promise you won't say it'll be like old times, OK?" He paused at the door long enough to say, "I'm going to do something productive now, like make up secret handshakes or find us a clubhouse."

Phil turned to his computer and called up Casper's appointment schedule. He allocated two hours on Friday morning for a meeting, and listed himself and Cheryl as requesting the time. For the topic, he entered "Seneca code restructure," then replaced it with "Rebuilding the universe in our own image," knowing that Mitsu would be honored by the plagiarism and Casper would be confused by the informality. He considered the words on the screen and ran one finger around the edge of the key that would commit the meeting to Casper's calendar. He then changed the topic back to the drier, more proper form, knowing that there would be plenty of time for surprises as the project unfolded, and there was no need to tip his hand just yet. ■

●Remember, it's uphill all the way; and when you get to the top it's still uphill.

Kelvin Throop

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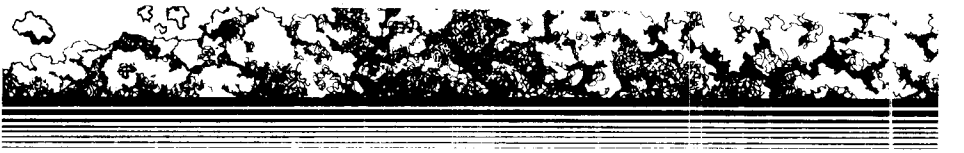

Probability Zero

ON SECRET WINGS

Dean McLaughlin

They toasted peace. They drank to the amity of nations and congratulated one another—and themselves—that they, in their wisdom, had threaded through tangled international frictions to a resolution of their mutual difficulties. Until next time.

And at last, when the final glass had been drained, the final speech droned out over muzzy, nodding heads, and the leaders of the most powerful nations had departed in their armor-plated limousines, the chiefs of lesser nations and the special guests (whose labors had made that evening possible) emerged from the great hall and dispersed into the cold of a Swiss winter's night.

On the long flight of steps, Valery Mischkin tramped down beside Peyton Bellamy. In the several years of negotiation, both formal and private, they had come to know each other well.

"A momentous evening, comrade."

"Yes." The word came out as a heartfelt sigh.

"A pity, though, that we could not resolve the matter of nonequivalent weapons systems."

"True," Bellamy regretted weightily. "But to balance cats against cabbages . . . we could haggle for a hundred years and not be done. Those industrious technicians. . . ." He shook his head. "New things every day."

"Ah! Indeed."

They proceeded down in companionable silence. At the foot, Bellamy turned left. Mischkin followed.

"You wished to say something?" Bellamy asked.

"Perceptive as always," said Misch-

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kin. "Yes." He nodded to where a walk led off across a small park full of shrubs and evergreens. "May I suggest . . . ?"

No further words were required. Such parks were a necessity of their trade; places where men could talk and walk, saying things to each other which, the next day—should their masters require—they could deny were ever spoken. In moments, they were alone.

"Now that our two great nations are friends," Mischkin said, hands deep in the pockets of his thick, long overcoat, "I shall be permitted to tell you a thing not previously revealed. Off the record. I am sure you understand."

A diplomat's ingrained caution made Bellamy pause. "Understanding that you initiated the disclosure," he said, "I'm willing to listen."

"Ah, old habits die hard!" Mischkin chuckled. "Do we not now trust one another?"

Bellamy permitted a silent laugh to be his reply.

"It is simply this," Mischkin said. "Like your own great nation, mine also has developed a fleet of undetectable aircraft. Virtually silent. What radar beams they fail to absorb they disperse into scattered directions by tricks of design and quantum mechanics, not distinguishable from transient noise. Their materials are nonmagnetic. They create no more disturbance in the atmosphere than a nightingale. Even the heat of their engines and their exhaust is disguised. Your territory has been overflown for several years and you have failed to notice. That, as you know, has been true."

The night was cold, but that wasn't the chill that touched Bellamy now. "We haven't detected," he said with care. "Neither have we seen the factories they would have needed, or the diversion of resources, or the evidence which technical publications would let slip. Things don't happen all by themselves."

"Those things, in my nation, can be controlled," Mischkin said. "Unlike your own. It is a simple matter of alertness and will."

"Mm," Bellamy said. His breath smoked the cold air. "They'd need airfields. Personnel. Communications. Our surveillance—"

"Would not be successful. To begin with, paved airfields are not a requirement. I tell you, comrade, they are not possible to detect."

Bellamy kept his voice firm. "You could not possibly," he insisted. "Our intelligence services have detected not a hint. Not a murmur. Do you expect us to believe. . . ?"

Mischkin gave a deep, warm chuckle. "Comrade, you have not been listening. I have told you. . . ."

A twinge in his middle told Bellamy that his ulcer had returned. For a moment he held silent. Lying, he thought. Had to be. And yet. . . .

And yet. . . .

If we tell them the truth about ours, he thought, will they give us the truth about theirs? He took breath to speak.

"Oh," he said. ■

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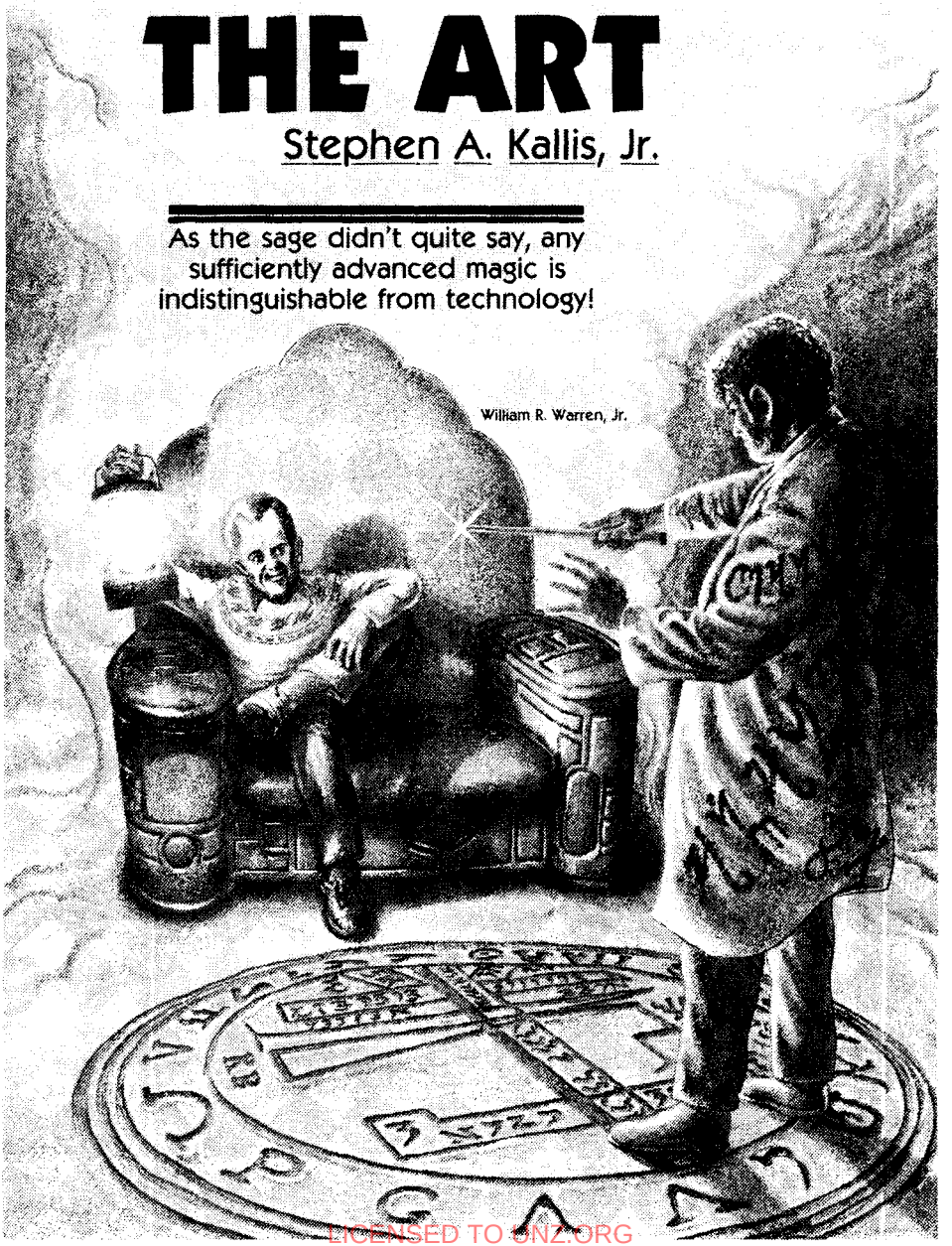
FATE OF THE ART

Stephen A. Kallis, Jr.

As the sage didn't quite say, any sufficiently advanced magic is indistinguishable from technology!



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Willard Craven sat none too patiently in his folding chair near the deserted crossroads and surveyed the scenery. The sky was clear, save for one thin streak of a cloud that looked a little too thin to be a contrail. The Sun was low, practically touching the horizon, and its reddish light added a nearly melodramatic dimension to the starkness of almost bare autumn trees. The Moon was a solid crescent, not yet half, yet capable of supplying some light for his operations. He consulted his watch, then rechecked his notes. Sunset would end in about ten minutes.

He climbed to his feet. He hadn't wanted to begin too soon, but he figured that in the waning rays of the Sun, he could unpack his paraphernalia. He opened the canvas carrier he'd brought, and, after putting down a cloth, started laying out the equipment he'd selected. As he placed incense burners, various herbal powders, and charcoal pellets down, he smilingly thought that if anyone could see him, they might think they'd dropped back in time a few hundred years.

He moved close to the roads' intersection and cleared a spot more than nine feet across. He smoothed the soil, then brought a sharpened stick of willow wood and a paper with a fairly complex diagram on it. As the last rim of the sun sank below the horizon, he started to copy the diagram in the soil, using the pointed end as a scribe.

In time, all the preparations were ready. According to ancient traditions, the date was the most favorabale for his work; and he'd found enough evidence to convince him that he wasn't wasting his time. He donned a robe with flowing sleeves, which he'd had embroidered with special symbols. Then he lit his incense in the correct order, saying appropriate words over the charcoal before sprinkling each of the coals in the burners with the special herbal powders he'd painstakingly concocted.

Picking up a rod made of ash wood that he'd harvested and prepared himself, Craven paused, facing East, and waited for the appropriate moment. Less than five minutes later, he *sensed* it was time. He felt a building potential, and as he began his chant, felt his words augmenting it.

The potential grew. Craven became aware that the air was still; and the strands of smoke from the smoldering herbs rose straight up into the slowly darkening sky. He intoned the words slowly, stretching his arm out so that the wand was pointing due East.

Outside the circle, something stirred. At first, Craven sensed rather than saw it, but a tiny ripple of something like a thin sheet of faintly glowing mist swept to the edge of the circle, but did not cross it. It seemed to settle, but then spread slowly around him until he and the circle were completely enclosed.

His heart began to race. Although he was certain he could achieve it, Craven understood that knowing the procedures was far different from experiencing the actuality. He knew he had to complete the process, though, and continued with both chant and appropriate motions until the procedure reached its end.

He paused, rod at the ready, waiting to see what would happen.

Locally, the misty layer thickened, then grew. A section of it billowed up slowly, reminding Craven vaguely of

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the puffy clouds he often saw in summer skies. When it reached a height of roughly half a dozen feet, it stopped growing, and began to thicken and brighten.

Craven found himself exhaling a breath he hadn't realized he'd been holding. So far, everything tracked with what he'd read in the ancient texts. By adhering rigidly to the old formula, he'd managed to evoke some sort of being from . . . somewhere. But where?

Thoughts racing, Craven quickly reviewed the alternatives. The procedure he'd selected was general enough so that whatever entity he'd summoned could be beneficent, maleficent, or neutral: the old texts were a bit vague on that. But all agreed that in order to maintain control, he'd have to take the initiative.

Taking command was the first step. "You there. Identify yourself," he said in a ringing tone.

"John Fillmore," said a voice from the glowing column of mist, with a faint trace of amusement.

Craven was taken aback. He'd been expecting something a bit more exotic, like Eligor, or Paimon, or even Atarael. What kind of a supernatural entity had a name like "John Fillmore"?

Pulling his rod back like a fencer looking for an opening for a thrust, Craven said, "Speak your name true, or face the wrath of this blasting wand."

"Oh, it's true enough." The voice paused, and after a moment resumed. "Ah, it becomes clear. It's the teleplasm. Still too thick. A moment, and I'll disperse it."

Before Craven's startled gaze, the glowing column of mist swirled gently, thinned, and disappeared. As it did so, it revealed a man sitting in a large, thronelike chair.

"There. That's better."

Craven stared for a moment. In the waning light, it was a bit hard to make out the man's features, but he looked . . . well, not demonic, at any rate. "Who are you? What—?"

The man chuckled. "Look. It's a bit dark. Let me provide some light." He got up and opened a compartment in the side of the chair, and took out a battery-operated fluorescent light.

"I prefer this to those light sticks," he said casually. "The sticks take up less room, but this is a bit more natural."

He flicked the lamp on, and regarded Craven. "Ah, as we thought. Another loner. Nice getup."

Craven studied the other. Fillmore looked a bit on the thin side, but not scrawny. He was about Craven's height, looked as if he were in his early forties, and had thinning hair. He was wearing a pullover sweater and denims, and was shod in sneakers.

The chair he'd been in was another matter, though. It was wooden and massive. It had thick arms that were paneled. Along its outer surfaces, it was inscribed with symbols and diagrams that, while unfamiliar, seemed related to the circle Craven was standing in and the robe he was wearing. Each panel apparently could be opened to reveal a compartment, such as the one that Fillmore pulled the light from.

Craven moved his wand hesitantly. "I repeat. Tell me who or what you are."

Fillmore raised his eyebrows. "Are

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you serious? Do you believe I'm some sort of . . . demon . . . summoned from the pits of hell? How charmingly . . . medieval.'' He chuckled. ''But, of course, you're a loner and perhaps the only thing you have to go on are the various grimoires.''

Nodding, Fillmore started forward. ''Now you know that every tradition agrees that nothing discarnate or transcarnate can do this.'' He stepped into the circle. ''Now see? If I'd been anything demonic, the circle would have stopped me, as it did the teleplasm.''

Craven stared at the man, then at his wand, then back again. ''But if you aren't a . . . whatever you called it . . . just who are you?''

''I gave you my name already. Not that it'll do you much good, either way, despite some traditions.''

''I don't know. . . .'' Craven sighed, a suspiration tinged with some frustration.

Fillmore regarded Craven for a moment, then said, ''Look. You didn't expend all this effort for nothing. You created a summoning, and you got me. Not what you were expecting, perhaps—''

''That's for sure!''

''—so, ask yourself. Why did you go through all this work?''

''Well. . . .''

''For the same reason I became what I am.''

''And what's that?''

Fillmore smiled. ''A sorcist.''

''Exorcist?''

Fillmore chuckled. ''Not at all. Since you've successfully performed a summoning, what . . . how would you term yourself?''

''I don't know. A spell caster? An adept? A magician?''

''All good terms. Or you could have said, 'a magus,' which might have been a bit presumptious, or 'a practitioner,' which sounds pompous and a bit medical, or 'a sorcerer,' which, while it technically implies evil, is linked in the popular mind with people who can perform what's called 'magic.' ''

Craven digested that. ''Well, OK. But what does that have to do with you and what you do?''

Fillmore reached into a pocket. ''I usually bring along one of these when we suspect a loner is operating.'' He dug out a card and handed it to Craven.

At first glance, it looked a bit like one of the tarot cards. It showed a picture of a man in sorcerous robes, holding a wand over his head. On a table before him were several traditional magical instruments, including an athame, a thurible, and a chalice.

Craven studied it for a moment. ''So?''

''Turn it over.''

On the back was another picture. It was of a man bending over a work table on which there were mortars, pestles, crucibles, and what from Craven's readings he recognized as an athanor.

Fillmore said, ''Can you identify the man's profession?''

''Obviously a medieval alchemist. I don't see the connection.''

''Well, not everybody does at first. Suppose that fellow wanted to get a job today. Where would he go?''

''I understood true alchemy was. . . .''

Fillmore smiled. ''Never mind that,'' he said quickly. ''And please don't argue with a suppositional question.

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We'll assume this fellow, for all his zeal in trying to develop the—what was it?—the alkahest, understands some of the consequences of simple chemistry. He might have learned that aqua regia dissolves gold, though he wouldn't have known why. Now armed with that level of knowledge, he tries to find employment today. Where would he go?"

"Umm. Well, didn't the alchemists get rich sponsors?"

"That's not a very satisfactory answer. Admittedly, if he was enough of a con artist—and I don't doubt that many of his brethren were—and lucky, he might be able to find a well-off person silly enough to sponsor his researches. But they'd be hopelessly outdated. And to go to a major company, well, I don't need to elaborate."

Craven studied the picture closely, then turned the card over and studied the other picture. "You're saying that what I'm doing is to magic as alchemy is to chemistry?"

Fillmore nodded. "We don't call it 'magic,' though: that's semantically coupled with the stuff Houdini, Blackstone, Randi, and David Copperfield do—stage stuff. Just like 'chemistry' is derived from 'Alchemy,' and 'Astronomy' is derived from 'Astrology,' we've derived a new discipline from 'Sorcery': 'Sorcistry.' "

"Which makes you a 'sorcist,' like you said."

"You've got it. Just like a person whose profession is chemistry is a chemist."

Craven stared at his wand, then glanced back to Fillmore. "But everybody knows about chemists, and I've never heard of sorcists before."

"There's a reason for that. I think the easiest way to explain is if you'd take a short trip with me. We'd be back shortly."

Craven studied the chair Fillmore had arrived in. It certainly was wide enough to accommodate two people. "You mean in that?"

"Sure. Beats airliners."

Craven's thoughts raced. There were a lot of stories about people who ventured out of their protective circles and were set upon by demons, and that demons would use any ruse to entice the unwary from their protection. But those stories also indicated that demonic agents couldn't cross the protective lines. He thought of the years of study that he'd put in, and that he'd just learned of an organization of like-minded people. On the other hand, why the secrecy? And yet. . . .

"About how long?"

"Oh, no more than an hour or two."

After a moment, Craven said, "OK."

As Craven was packing away most of his stuff, putting it in his car and locking it, Fillmore opened another panel in the chair and took out a small object, plus a magnetic compass.

Craven returned, just as Fillmore was taking a compass reading.

"What are you doing?"

Without glancing up, Fillmore said, "I'm taking a bearing and comparing it against Polaris. I need to know the magnetic variation, since the orientation of the resonator works best halfway between true and magnetic North."

"Resonator?"

Fillmore noted something on a scrap of paper and straightened up. "This."

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He handed Craven a small object, rather like a five-sided prism with a metallic cap. Looking closely, Craven could see symbols scribed or etched into the metal, which was an odd light gray color in the fluorescent light.

"What's it for?"

"To get us back here. You sent out a summons, after all. I don't even know where I am, other than it's in the continental United States. So if I want to return, I need some means of pinpointing my destination."

"I guess that makes sense. How does it work?"

Fillmore retrieved the object and placed it carefully in a slight depression he'd dug in the ground. As he was adjusting its orientation, he said, "I won't go into the theory, but think of it like a reflector—the kind of stuff some joggers wear so they can be seen at night. This one's keyed to the chair, and if I leave it somewhere, I can come back for it. It's made out of a special quartz and capped with a modified form of the ancient speculum alloy, zone refined to get the optimum ratios of metals."

"I see," Craven said a bit uncertainly.

"Oh, don't worry about it. You'll learn lots more. Anyway, are you ready?"

"As ready as I'll ever be."

Fillmore stood up and dusted himself off. "OK, to the chair."

The two fit a bit snugly, but it didn't prevent Fillmore from making a couple of passes with his hands. As he did so, the scene, which had become much darker after the lights had been extinguished and stowed, seemed to become a bit fuzzy.

"It's the teleplasm," Fillmore responded to the unasked question. "Outside, you see a glow; inside it, you see things a bit less sharply. It has to do with energy balances; you get used to it."

Fillmore stopped talking and made another pass with his hands.

The scene before them grew slightly darker, and the crescent of the moon smeared out to twice its thickness, then defocused. Like a movie, as the scene became less distinct, a second scene appeared faintly, also out of focus. The second scene grew in intensity, growing closer to sharp focus, as the initial view disappeared.

Fillmore waved his hand once more, and the scene jumped into sharp focus, and became a bit brighter. "That gets rid of the teleplasm," he said.

Craven scarcely listened. He found himself in the middle of a complex with a number of people engaged in activities of various sorts. To one side of him, he could see a few thronelike chairs nearly identical to the one he was sitting in. In front of him was a large space of clear concrete floor; past that, a wall with markings in a square pattern with special figures inside, inlaid using some metallic substance. The pattern reminded him of some of the diagrams in the books he'd studied, but this was somehow *solider*.

Fillmore stood up and stepped away from the chair. "That's better. These really hold two in a pinch, but it's better to go solo."

Craven stood up and glanced around. He noticed that the others he could see were dressed as casually as his companion. He felt very conspicuous in his

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robe, but since he'd stripped to his underwear before donning it, there was little he could do about it.

Turning, he saw what had been behind him. Overhead, suspended in the air, was a large globe of glowing substance. It reminded him of the mist that his companion called teleplasm, but this was much brighter. He estimated that it was some ten feet off the ground, and at least half again as wide.

"What's that?"

"Teleplasmoid. It's a concentration of teleplasm, held in place by manonical fields. Some effort to set it up, but very easy to maintain. It's our base source of teleplasm for transport."

"I don't understand."

Fillmore smiled. "Of course not. Teleplasm is the means we can . . . oh, for a word that you're likely to know, apport. Transport objects, with or without ourselves, across distances."

"But why the globe of the stuff?"

"Energy balancing. When you change geographical positions, there are differences in height, relative motion, and the like. The teleplasm provides the transport, of course, but with this energy concentration, it adjusts for kinetic differences; or, rather, the activating . . . spells . . . do. It wouldn't be a bit pleasant if one popped over to a spot with a relative velocity difference of several hundred feet per second."

"Oh."

Fillmore clapped Craven on the shoulder and said, "Well, come on. I'll give you the standard tour of the place."

The sorcist led the way out of the central area. Craven followed, noticing that occasionally one or another of the people working at different things would glance in his direction and smile.

The first stop was outside a room where a woman was sitting at a computer workstation with a large projection workscreen. On it was a mosaic of what clearly were symbolic protective circles similar to the one Craven had traced in the dirt before beginning his ceremony. Periodically, she would move one of the images over another, and turn to a smaller screen by her side.

"This is one of our symbolic evaluation areas," Fillmore said. "By the looks of it, she's trying to establish the degree of homeomorphism between various symbols."

"Homeomorphism?"

"We've had to borrow and adapt terminology from other disciplines. 'Homeomorphic' is a topological term; we've adapted it to represent a type of symbolic identity. In various grimoires, there are differing blocking symbols—I hate to say 'pentacles,' since few are associated directly with the fivefold condition—that have grossly different structures, yet have some deep levels of symbolic correspondence, or at least close similarity. The young lady is analyzing these for their degree of symbolic identity. It's a grueling process, even with computer-driven high resolution workstations: the real work is being executed in a much larger computer in our processing center over a network link. If you had to do this sort of thing by hand, it might take decades to establish even the most tenuous identifications."

"I see," Craven said quietly. He glanced at two of the symbols, one square and another circular, and failed to see how there could be any common-

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ality. But then, he was beginning to learn that he wasn't a specialist.

Fillmore led him down the hall to another room. Looking through the window of its door, he saw an older man standing before what had to be a geophysical globe of the Earth. As they watched, the man raised a black wand and swung it in a complex motion in front of the globe. The man paused, and slowly, pale spots of light started to appear here and there on the globe.

"What's he up to?"

"He's researching what some mystics have called 'power spots.' And their connection, if any, with what have been designated as 'ley lines.' He's established that there's some form of force contentration at many, though not all, of the sites, and he's trying to analyze them and their relation to the energies we currently understand."

"And the globe?"

"A symbolic means of bringing the world into the laboratory."

"Like a computer simulation?" Craven asked hopefully.

Fillmore shook his head. "More like a special form of . . . simulacrum . . . a highly miniaturized version of the planet, in a sense."

"In a sense?"

"He's had to filter out certain energies. A full explanation's a bit technical. But he's left with what he needs."

Craven suddenly had sympathy with the hypothetical alchemist, imagining him taking a tour of a state-of-the-art petrochemical plant. "Oh."

"Want to see any more?"

"I think I've got the picture."

"Good. Let's find a quiet spot."

Fillmore led the way to a small room in which there were a few chairs and a table. On the table were a small computer terminal, and an object that looked like a fancy bread box, made of a grayish metal. Embossed on all sides of the box were different symbols, some of which looked talismanic.

"Have a seat," Fillmore said. "Are you hungry or thirsty?"

"Both. I haven't eaten since—"

"Of course. Most of the grimoires suggested or insisted on abstaining from food or drink before attempting a spell. Sorry it slipped my mind. Well, no such restrictions really apply." Fillmore sat so he could use the terminal.

Craven said, "You mean, that rigamarole wasn't necessary?"

"Not the abstaining from food and drink, at any rate. I can't be sure about the other unless I know what approach you employed."

Fillmore pulled the keyboard to him, and started typing in a command. "We prefer simple terminals for this sort of thing. An icon-driven workstation gets a bit in the way of people whose specialties include symbolic manipulation. What would you like to eat?"

Craven regarded the setup. "Can you conjure up anything with this?"

Fillmore chuckled. "No, not at all. This isn't a fairy tale, and that's no cornucopia. Look on the screen; it shows you the categories of what's available. We keep enough food on hand in the cafeteria refrigerators and freezers. Once you've made your selection, I'll set the conditions to transport the stuff right to an elemental chamber if necessary, then up to this station."

" 'Elemental'? What's that?"

"Remember how the ancients used to

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categorize the 'elements' as Air, Fire, Water, and so forth? Some even suggested that each type of matter had its own creature manifestation."

Craven nodded. "Undines for water, salamanders for fire and so forth. 'Elementals.' "

"Right. Well, it happens that there are energy planes that can be used to effect the conditions of the ancients. To differentiate them from the actual elements, we call them 'elementies'; not very elegant, but a name's a name."

Craven digested the information for a moment, then brightened. "I see! An elemential chamber is one where the appropriate elementie is stored. If you want to warm up food, you'd go to a fire-elemential chamber, right?"

"Good guess. Except that we don't store elementies; we attune the chamber to the appropriate one. Say you want a hot dish. It's transported to an elemential chamber in attunement to the fire component, then to here. In seconds. Beats microwave ovens."

Craven scanned the menu and indicated what he wanted; it arrived in seconds, complete with disposable plastic cutlery.

Fillmore picked up a sandwich and began to eat. "So, now to an explanation of all this," he said, smiling. "You said you'd never heard of a sorcist, and you're right. This is what we might call a hidden profession."

"Why?"

"A number of the older traditions have a grain of truth. In particular, the matter of the Talent."

"Eh?"

"You may not have read about it, but traditions are that only certain people can handle what, for the moment, I'll call 'magical' forces. Being able to do so is called 'having the Talent,' and not everybody has; it's genetic."

Craven nodded. "I suppose, since I was able to call you, I've got it."

"Right. Now, as it happens, the Talent's rare—maybe 1 in 100,000 has it in any degree. And it's an essential ability in order to practice sorcistry."

"OK, but why the secrecy?"

"Because it's easy to get exploited, that's why. Not everything's as nice as one reads in civics books. And if the general populace, even in a democracy, learned that there were people who could actually practice 'magic,' we'd soon find ourselves conscripted. Some of those with political connections can be a pretty ruthless bunch."

Carver glanced around, taking in the huge facility he was in. "But if what you say is true, how can you possibly afford a place like this?"

Fillmore laughed. "Two ways. Many of us hold down a 'regular' profession, and we put some of our income towards this. A few of us use sorcistic means of locating treasures or valuable ores; some of the proceeds are funneled through dummy corporations to our society."

"I see."

"Through sorcistry, we can cover enough of our financial tracks so we don't get audited," Fillmore said, smiling. "We can't be invisible, but we can be, well, unnoticed."

"But what does your . . . society do?"

"Oh, research. Advancing the state of the art. That sort of thing. We're completely apolitical."

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Craven tugged at an earlobe. "And you responded to my summons to recruit me?"

"Sure. There aren't that many of us, and you've got the Talent in good measure. You've seen some of what we can do. To learn a new, well, discipline, isn't easy, and you'll have to unlearn some stuff before you can make real progress. But it's very satisfying."

"Unlearn?"

Fillmore nodded. "Sure. Remember the alchemist? He'll have to throw out his concepts of . . . what was it? putrification and purification? . . . and learn about valences and oxidation states before he could become a chemist. Similarly, you'll have to chuck out much of what you read in the grimoires and learn about such things as iliastric fields, plasmic theory, and sympathology to become a sorcist."

Craven stared at his host, thoughts racing. "It's like going back to school again," he said, a bit wistfully.

"You could look at it that way. Interested?"

Craven thought back at his years of study, his trials and errors, and his one successful summoning. "Yes . . . of course."

"There's a 'but' in there," said Fillmore. "What's wrong?"

"Oh, don't misunderstand. I'm really interested. It's only. . . ."

"Yes?"

"Well," said Craven, "all of this new information has . . . has taken most of the magic out of what I've been doing." ■

●[I have never forgotten]...a proverb of the Buddhist religion:

"To every man is given the key to the gates of heaven; the same key opens the gates of hell."

What, then, is the value of the key to heaven? It is true that if we lack clear instructions that enable us to determine which is the gate to heaven and which the gate to hell, the key may be a dangerous object to use.

But the key obviously has value: how can we enter heaven without it?

Richard P. Feynman

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The Alternate View

WARNING!

G. Harry Stine

I thought the headline on this column might catch your eye.

But you, dear reader, are unique. You're not the typical American. (And don't automatically assume that you're on the high side of the three-sigma point, either.)

Americans no longer read warning notices.

In some cases, they cannot read anything; they're illiterate.

That doesn't make much difference. No one reads warning notices. Period.

To those of you who still smoke cigarettes, do you read the warning label printed by government edict on each and every pack of smokes? How long since you've read it? Do you know what it says? Do you care?

Deeply graven on the side of every automobile tire sold in the United States today are warnings. Several of them. Do you know what they say? Do you know what they warn against? Does it matter to you, even though your life is riding on those tires at 55 miles per hour (or faster)?

Many of you own a computer. Sometimes several computers. Have you read the warning notices that appear in the instruction manual for your computer? Do you know what they say? Can you understand what they say? Is the warning meaningful to you?

Here's an example that comes from my computer's instruction manual:

> Warning
>
> This equipment has been certified to comply with the limits for Class B computing devices, pursuant to Subpart J of Part 15 of FCC Rules. Only periferals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with noncertified periferals is likely to result in interference with radio and TV reception.

So?

So what if I buy a used Hewless-Buick Ink Squirt Printer and plug it into my computer's parallel printer port? Do I check the label on the printer to assure myself that it too is certified to comply with the Class B limits (whatever they are)? Probably not. Suppose the warning label has been torn off or worn off (it's an old used printer). As a result, my neighbor's TV goes toes-up when I print my *Alternate View* column. He probably takes his set to a TV repair shop and is told to put this handy little RFI filter on the power plug. Suppose he wants to report the interference to the FCC. Have you ever tried to find the telephone number of a specific federal agency? Does he call 911? Do the feds come and take me away?

As readers of this column are aware, I own a Piper Cherokee. This is one of the simplest, strongest, most reliable, and best designed airplanes ever built. More than 37,000 of them have been produced at Vero Beach, Florida. That's a lot in an industry where every

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product is virtually hand-built. Most aircraft production runs are a couple of hundred units. Boeing is proud to have sold nearly two thousand 737 airliners thus far.

I've flown my 1969 Cherokee since 1977. It performs exactly and precisely according to the book after all these years.

However, my car is far more complex, fragile, unreliable, and deadly. It has absolutely no dashboard warning placards at all.

My Cherokee has three placards "in full view of the pilot." The FAA obviously believes I'm going to read them every time I look at the instrument panel. This includes when I cannot see the wing tips for the clouds while trying to land in weather conditions that cause birds to walk. One placard warns about how not to get into a spin. It also tells me how to recover from one. If I get into a spin, I'm supposed to freeze-frame everything while I read a 150-word warning placard? Sure!

Federally mandated warning labels are now so ubiquitous that you can probably be nailed any time the federal government wants to nail you for violating some federal law or regulation. Sort of like the old bit about not destroying the tax stamp when you open a pack of cigarettes and going to jail as a result.

Therefore, the warning labels have become totally meaningless.

But warning labels required by federal law or regulation aren't the only ones being ignored by everyone.

Here's an example:

WARNING! To prevent electric shock, unplug before cleaning.

This appears in 6-point type (barely large enough to be readable) on a sticker on the *bottom* of my electric toaster.

The following label (also in small print) is on the back of my VCR:

WARNING! Contains high voltage electrical circuits. Do not attempt to open or remove the cabinet. There are no user serviceable parts inside. Servicing of any nature should only be performed by authorized service personnel.

If anyone reads that, they'll probably ignore it. Some Americans realize when technology is beyond their level of expertise and will therefore take a malfunctioning VCR into a repair shop. However, most of us believe that we possess Yankee ingenuity. No technology is beyond our comprehension. No device is beyond our ability to stumble through and fix. In short, we can handle it. Obviously, that warning label is merely a ploy on the part of a greedy electronics industry to get us to take the unit into an expensive TV repair shop. "Hell, I'll just get in there and have a look. Maybe the tape jammed or somethin'. I oughta be able to fix that!"

Some of us can and some of us cannot.

Some of us will get bitten by technology—in this case, 120 volts or more.

I have a "high resistance" friend. He's good at installing and repairing 120 VAC house wiring. He never bothers to use a voltmeter or a hot light. He just puts his thumb and middle finger across the terminals. He has such high skin resistance that it doesn't knock him on his can. He says he just gets a tingle. He maintains his method is more positive than relying on a voltmeter that may be broken or a hot light that may be burned out. Most of us try this only

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once, usually by accident, but we aren't "high resistance" individuals. So don't try it! That's a warning, of course. . . .

Here is a somewhat longer warning that appears in an instruction sheet. Versions of it appear in other instruction sheets, too:

> XYZ Corporation certifies that it has exercised reasonable care in the design and manufacture of its products. As we cannot control the storage and use of our products, once sold we cannot assume any responsibility for product storage, transportation or usage [sic]. XYZ Corporation shall not be held responsible for any personal injury or property damage resulting from the handling, storage or use of our product. The buyer assumes all risks and liabilities therefrom and accepts and uses XYZ Corporation products on these conditions.

Aha! Now we are getting to the real heart of the whole warning issue!

The key words here are *risks and liabilities*.

I was taught how to behave with technology so it wouldn't hurt me. I do not stick my finger into the light socket! I learned how to handle acids in the chem lab. I try to learn how a given technology can bite me before it does. I still have both eyes and all my fingers. My hair is on my head instead of on the ceiling.

I was also taught to assume responsibility for myself and my actions. And I learned to take risks because they are part of living. No guts, no glory. "Behold the turtle: He makes progress only when his neck is out." When your neck is out, your head can be chopped off easily. So evaluate the risks, but don't be afraid to take them.

Because the schools and the family don't teach these sorts of things any longer, we have a proliferation of warning labels that no one reads.

The federal government requires warning labels of various sorts to assure usage in accordance with federal law and regulations. These were set up to protect the world from idiots, and idiots from themselves.

On the other side, lawyers and the courts are out to assure that injured idiots are protected from technology. The idiots become eligible for the award of large tort liability settlements (accompanied by large percentage fees for the attorneys). These eliminate the need for idiots to worry about money for a long time.

This also rewards stupidity and illiteracy.

But maybe these idiots aren't so stupid after all. They and their attorneys have discovered a way to make a living without really working. . . .

The key word in the above liability warning statement should be *responsibility* as applied to the buyer and user.

But it isn't.

Maybe Shakespeare was right.

However, I should not bite the hand that helps feed me. I do some expert witness consulting on various tort liability injury cases. Experts have to be called in to help explain technology. Since I've been an expert witness for several tort liability cases, I guess I qualify as an expert. Sometimes I'm on one side, sometimes the other. But I don't sell my soul to the devil. I've never served as an ex-

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pert witness for an idiot. However, this revelation should lend some credence to the possibility that I may know something about our current tort liability situation in this country. That situation isn't good. And it isn't getting any better at the moment. It's too lucrative. Which should come as no surprise to anyone who understands the great guiding principle upon which this country was founded: Money Talks.

Obviously, the "easy way out" is to pass more legislation, adopt more regulations, add more warning labels, and print more warning statements.

But that's what we've done, and it hasn't worked in keeping people from being hurt by technology.

Or maybe it has. Let's take an alternate view.

Some two decades ago, the price of an average new car amounted to 17% of a person's annual salary, according to US Department of Commerce numbers. Thanks to government requirements, regulations, and mandated safety standards, a new car now costs 78% of a person's annual salary. (Any questions about why the automotive industry is in trouble?) I don't see any data that tells me the mandated safety and environmental requirements—which are of the same kind but not the same degree as warning labels—have reduced the number of auto fatalities (about 60,000 per year, more than the number of soldiers we lost in Vietnam) or significantly cleaned up the air in our cities. On the other hand, these mandatory standards are pricing automotive technology out of the range of the average buyer. Keep it up and pretty soon no one will be able to afford a car. That will certainly lower the carnage on our streets and highways.

And we'll all be going when and where Big Brother wants us to go on mass transit. And we end up like Eastern Europe where this has been the situation for decades.

I don't know what to do, but I'm thinking about it. I never promised you any answers. However, until we can figure this out, I think I have an interim solution.

It's a simple statement that can appear as a label or a placard or a statement in manuals:

WARNING!

Ignore all warnings!

Might as well face reality at last. We ignore the warnings anyway. And I'm sure no one will pay any attention to this warning. ■

●Give me six lines written by the most honorable of men and I will find in them an excuse to hang him.

Cardinal Richelieu

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analog
SCIENCE FICTION & FACT

CONGRATULATES THE WINNERS OF THE 1990 HUGO AWARDS

Best Novel
The Vor Game
by Lois McMaster Bujold
(major portions originally published in *Analog*)

Best Novelette
"The Manamouki"
by Mike Resnick
(*IAsfm*, July 1990)

Best Non-Fiction Book
How to Write Science Fiction and Fantasy
by Orson Scott Card

Best Professional Artist
Michael Whelan

Best Fanzine
Lan's Lantern

Best Fan Writer
David Langford

Best Novella
"The Hemingway Hoax"
by Joe Haldeman
(*IAsfm*, April 1990)

Best Short Story
"Bears Discover Fire"
by Terry Bisson
(*IAsfm*, August 1990)

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Gardner Dozois

Best Dramatic Presentation
Edward Scissorhands

Best Semiprozine
Locus

Best Fan Artist
Teddy Harvia

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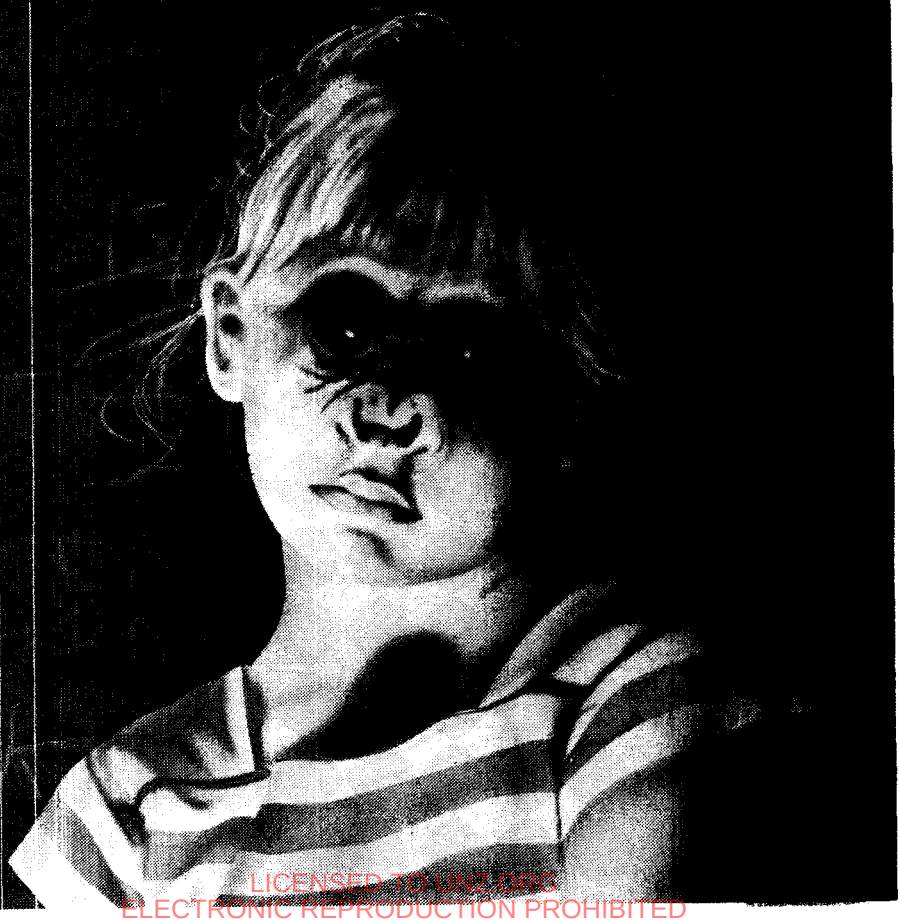
With maturity we need to put the bad parts of our past behind us. But not too far behind. . .

NEVER FORGET

David J. Strumfels



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"Nigger!"

Kara flinched, just before she got control of herself and remembered what daddy had told her: "Don't pay no attention when a white man says that. Don't even look at him. Keep your head up high, and they can never touch you. Remember you're better than him, no matter what he says."

"Go back where you came from, nigger!"

The policeman was sympathetic. Kara had heard that the cops could be the worst of all, but this one didn't seem to have any malice in his face at all. Just sorrowful eyes which said, "I know what it's like; I've been there myself." Perhaps he was Irish, or Polish, or a Jew, although how anyone could tell the difference between white folks was beyond her.

"We're comin' for you tonight!"

The policeman turned, but the face sank into the crowd before it could be picked out. Turning back to Kara he said, "I'm afraid this is where I take leave of you, miss. I wish I could stay, but—I don't know why you people want to move into this neighborhood. People should stay with their own kind. You're just asking for trouble this way."

"Kara Washington! Come inside this instant."

Thick, dark hands grabbed Kara and she was on the other side of the screen door in an instant. Hostile eyes interrogated the white face.

"Evening, Mrs. Washington," the policeman said. "I saw your little girl walking home and thought it might be safer if she had an escort."

"We can take care of ourselves just fine."

The green eyes were full of pity. "Yes, I'm sure you can. In that case, I'll take my leave. Good night. Oh—don't forget to lock your doors at night; this neighborhood is more dangerous than it looks."

He turned and they watched the blue uniform cut a path through the welcoming committee. Someone shouted, "Figures a mick would be a nigger lover," and another offered, "Go take a ride in the paddy wagon."

Mrs. Washington closed and bolted the door, then kneeled down to her daughter, taking the round face in her hands. "What did he do?" she demanded. "He didn't touch you, did he? Answer me!"

Kara shook her head. "No, ma'am. We just walked home. That's all. Honest." That was the truth, and she could tell her mom believed it, but somehow the fear and the hate would never entirely go away. Daddy was the same way. Why couldn't they see that the policeman was just a nice man who wanted to help her?

They didn't eat dinner that night. Daddy bolted all the doors and closed all the window shutters, and was ready to whip her when he caught her peering through the slats at all the people outside. Mom stopped him in time, however, and the penalty was reduced to being sent to her room. She could still hear the commotion going on out front though. What were they doing? What did they want anyway? *Why am I shivering?* She realized she was close to tears, and fought them down. What she needed now was her doll, Jessica. But Jessica was still buried in a box somewhere, out in the kitchen, in one of the

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boxes they hadn't gotten around to unpacking.

"Get them—get the niggers—"

The voice sounded like it was right outside the house! She drew up into a small ball on her bed, Jessica instantly forgotten. Then there were more voices; shouts and angry defiance were being hurled against their home like a hail storm. She could make out only bits and pieces of it—"go back where you came from . . . we don't want your kind . . . only good nigger is a dead nigger . . ." —but the thrust was an unmistakable tide of hatred, a terrifying syncopation which seemed about to bring the walls down around her.

Still, in all that, the sound of shattering glass was like an explosion inside her head. Her scream was echoing about her before she even realized it had come from her.

"Get them!" Distant and close at the same time.

"Mommy!"

Her mom was there in seconds, holding her trembling body and pulling slender, roughened fingers through her short, curly hair. "There, there," she said. "It's all right. It was only a rock. We're not scared of rocks."

But another window exploded at that moment and made a liar out of her, for she seized Kara in a hold like the one she'd used when those men in the white sheets burned that cross on Derringer Hill.

They sat there like that for many long minutes, with the shouting and shattering glass and clatter of rocks striking the house swirling around them, getting steadily closer as the pack moved in. How long it would have gone on like that if the door hadn't flown open to reveal daddy standing there with something ugly and metallic in his hands, Kara didn't know.

"George, what are you going to do with—that thing?"

His face was nightmarish in its resolution. "Ain't nobody is gonna push me outa my own home, not even a white man."

"No, George, don't . . . " She threw herself at him.

Huge, rough hands, hands that could hold Kara as easily as she could hold Jessica, pushed the pleading form from him and threw it back onto the bed. Kara saw that her mother was crying. The storm of rage continued its relentless assault on the house. She looked up again; her father was gone.

Something smashed at the front door, followed by a report that made Kara's heart jump. The sound repeated itself—and then there was silence. The voices and glass and rocks simply stopped, as though someone had thrown a switch.

Kara followed her mom out into the kitchen, where the woman sank to her knees and turned her eyes from the gory scene. The boy—he couldn't have been more than fifteen—had fallen forward on the boxes, which were already soaked with the blood which was oozing from the hole in his chest and making a neat puddle on the linoleum. The axe lay where he had dropped it.

Kara looked up at the smashed door. There was another white face in it. Like daddy, it was also holding a metal maw. There was a flash and another report which seemed to burst right through Kara's ears and reach into her brain,

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and she saw her father stagger backwards from some terrific impact. Someone was screaming. . . .

The faces scrutinized Lisa as she sat down. Five faces, a medley of colors and cultures which only a century ago would have given a start to even the most liberal minded of their great-grandparents, yet which nobody even noticed now. Lisa felt pleasure in that, yet also foreboding, for it meant understanding would be hard to come by. The one common expression on those faces —revulsion—confirmed that fear.

Dr. Frederickson folded his hands across the broad oak desk which separated accused and accusers, and looked Lisa directly in the eyes. "Do you understand why you have been asked to appear before the board?" The tone of his voice was that of a school principal interrogating a student suspected of butting in line. It was polite but relentless, a voice which knew you were guilty and would shame you into admitting your crimes no matter how long it took.

"I know a number of parents have complained that I've unnecessarily upset their children," Lisa answered. "I'd like to say that—"

"Upset? Upset? You call forcing children to experience life as an inmate in a Nazi concentration camp merely upsetting them? You call a child who is terrified to go to sleep at night because of nightmares upset? Or who can't eat because he's been vomiting for two days straight? That's being upset to you? Certainly the word traumatized is more appropriate under the circumstances, don't you think, Ms. Jiang?"

She was trembling already. I should have taken a couple of tranks before I came here, she thought. But she needed to have her mind clear. If any of them even suspected that she was on anything—

"The cyberlink is a required teaching tool by colony law," she reminded them, more to calm her nerves than anything.

It was the wrong thing to say, and Frederickson jumped on it. "I see. And should a lesson in nuclear fusion involve a tour through a working tokamak?"

"No, obviously not," she conceded, confused by the analogy. There was something wrong with it. If she could just stop shaking—

"Then please explain why a twelve-year-old has to find out what it is like to be gassed to death firsthand in order to learn history."

Lisa's stomach churned and boiled at that accusation. "Now wait a minute. We never went that far. What kind of monster do you think I am?" She glanced at the other members of the board. They couldn't let Frederickson get away with that.

"I don't believe that was on the list of complaints," Dr. Nwugwumo, at the other end of the desk, confirmed.

Frederickson gave Nwugwumo a poisonous look before returning to Lisa. "Of course it isn't. I withdraw the charge. My apologies, Ms. Jiang."

"I would *never* do something like that," she pressed her unexpected advantage. She addressed all of them. "I love children. I would never do anything to hurt a child if I didn't think it was absolutely necessary. If you've studied my psyfile, you know that's

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true."

"Your psyfile is beside the point—"

"That's the second time you insisted that it was necessary," Dr. Kholev interjected, to three sets of raised eyebrows and one furrowed pair. "Maybe if the board understood why you feel this way. . . ."

Thank you. Why did it always take a woman to start the process of listening anyway? Sometimes Lisa wondered if there was something to sexism after all. Taking a moment to compose herself, she turned to each of them. "Have you ever been called a nigger? Or you a wog? Have you ever been treated as property simply because you were a woman? Or considered useless because you were elderly?"

There was an awkward pause with exchanged looks before Frederickson answered. "Don't be ridiculous; people don't do things like that anymore. That kind of thing has been abolished forever."

"Right," she said, "Only a shimp would do that."

"Exactly. What is your point then?"

She wiped the smile from her face before anyone could pick it up. Damn it, this was serious. The way her heart was throbbing told her that if nothing else. "Have you ever heard the saying, "Those who forget history are doomed to repeat it?" She looked around the table for signs of understanding. There were none. "Well, what my children experience they'll remember their entire lives."

Several members were looking at each other in confusion. Finally, Nwugwumo spoke. "I don't think any of us would argue with you on that point Ms. Jiang. But why? Why put innocent children through such extreme measures for the sake of a history lesson? Bigotry is dead; dead, buried, and forgotten. One look at the occupants of this room, including yourself, is proof of that. I know I can speak for everyone here when I say that I have never been discriminated against because of my color, sex, or personal beliefs." He scanned the others; even Frederickson was shaking his head in unquestioned agreement.

She almost found herself nodding with them. "Uh-huh. And of course you yourself—all of you—would never discriminate in such a manner."

"I should say not! The idea is outrageous."

"Then would you please explain, Dr. Nehru, your usage of the word 'loonies' at the last board meeting?"

Nehru's eyes popped open, as though he'd been in a dream. "I don't see what—"

"Just a word I know. Like kike, or wop, or kaffir."

"Really, Ms. Jiang, I—"

"And I see you accept the common definition of shimp as an unintelligent and uneducated human being," she turned to Frederickson. "You know very well that shimp intelligence is only a few points below human, and that there are shimps with PhDs."

Frederickson rose to the bait. "You're being ridiculous. Everyone uses shimp that way. They don't mean it."

"Just like they call asteroid miners bugs." She sighed. "I know. The children say things like that too. I didn't think they meant it either, until that shimp child joined the class."

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At her mention of the shimp child the walls of resistance they had thrown before her crumbled. "I don't understand, Ms. Jiang. Are you saying the child was mistreated? Why didn't you bring this to the board's attention before?!" Frederickson's face started to puff in anger but a hand gripped his shoulder and restrained him. "Please," Kholev said, "Let her finish. Ms. Jiang?"

Lisa met the other woman's eyes with relief, knowing she'd made her first ally. "You see, to you they're just words. But the children take it seriously. They *do* mean it. The problem is, some of them will grow up into adults who mean it."

She waited long enough for her words to be absorbed. "Is everyone blind? What do you think, some miraculous transformation of human nature occurred in the twenty-first century? The reason we overcame the existing prejudices was that technology had made the world small, had forced us to live and work together whether we liked it or not. That same technology is now spreading us out into the Solar System. And it's isolating human beings in environments much more varied than any on Earth. How many of you have ever even met a lunar colonist or an asteroid miner? All you know is that they look and talk and act funny—though no more than an Englishman did to a Kurd two hundred years ago.

"But I tell you what really frightens me. What's going to happen when we start engineering ourselves to fit in all those environments? Then there'll be differences that will make black and white, or male and female for that matter, look trivial. You want to talk about nightmares; I see places in my dreams that make Auschwitz look like a holiday resort."

She was really shaking now. But the words had come out strongly, confidently. She could see it in their faces, the consternation they tried to hide behind veils of authority. Even Frederickson was tapping his fingers together. "I think . . . surely you exaggerate, Ms. Jiang." He glanced around. "If there is one lesson we have learned from history, it is the evil of bigotry. There are certain mistakes that aren't like to be repeated."

"Frederickson, sometimes you are so *dense*."

Kholev was instantly the target of disbelieving glances. She scanned her colleagues. "Are you forgetting that my nationality was once ruled by an ideology officially dedicated to eliminating those evils? Do you know what happened when Marxism fell? We all went back to killing each other, just as much as when we were under the Tsars. I remember my grandfather telling me about it. He was a Jew, you know."

"My grandfather used to tell me about killing whites in South Africa." Nwugwumo piped in with a shudder.

Nehru nodded sadly. "I'm afraid I have some unpleasant stories as well . . . But that is all behind us now."

"Is it really?" Kholev turned back to Lisa. "The shimp girl . . . "

Lisa had known this was going to be the most difficult part. Taking a deep breath, "Some of the brighter children have improved in their behavior and attitudes. Two or three have even be-

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friended the girl. On the other hand, I have to report that some of the children seem to react to the hatred in their experiences by growing even more hostile. Even some of the brighter ones reacted that way.

"But we're learning," she emphasized, brightening. "I'm convinced that the right set of experiences, presented in the right way, will affect all the children in the right way. Sympathy for the downtrodden has got to be a universal human emotion—I mean, if it's not, we might as well give up right now. If we can just figure out how to reach that sympathy—we are making progress, I assure you."

Several embarrassed seconds of silence followed. "It sounds as though, wishful thinking aside, your experiment was at best a mixed success then," Nehru finally suggested.

"A commendable attempt, however." Kholev was half smiling at her.

"You can't possibly mean that Ms. Jiang should be allowed to continue this outrageous experiment of hers." Frederickson glared at Kholev, then turned to Lisa. The politeness was gone. "Some of those children are going to need therapy, you know. Who gave you the right to use children as guinea pigs, anyway?"

Somehow she resisted wilting under the heat of the attack she'd been expecting, that she had grown so accustomed to from her own conscience these last few weeks. She kept her gaze steady on Frederickson's eyes. "That's a question I've asked myself a lot of times. There are some things . . . I'm not sure you wait around to be appointed for." Again, she made the round of faces. "If you do that, they never get done." She fumbled for some more words. "I guess my answer is, I'm a teacher. It comes with the territory."

"It comes with the territory? What's that supposed to mean?"

She sighed. She'd known it wasn't going to be resolved, at least not this quickly. At least she could see that the faces arrayed against her were not a single hard opinion anymore. She had accomplished something. "It means—I guess it means I'll accept whatever decision the board comes to." She started up.

"You mean, you have nothing more to say?" Nwugwumo's chocolate rich features frowned in perplexity. "You understand, Ms. Jiang, you may face dismissal over your actions. There will surely be a lot of pressure from concerned members of the colony to do so. Without a doubt the board will be forced to take some disciplinary action."

"Perhaps if Ms. Jiang were to agree to suspend her, uh, unique use of the link pending further evaluation—"

"Agree to suspend?! I hope if there is one thing perfectly clear from these proceedings—"

"I don't know about you, Frederickson, but I for one do not wish to be associated with the forces of hatred and bigotry. The treatment of the shimp child will also raise a few eyebrows."

"You're not threatening *me* with blackmail, I hope."

"Members, *please*. This is not the time or place for quarrels. Especially personal ones. Ms. Jiang's career may be at stake here."

What could she say? That was the

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least of her problems. She turned to leave. "That comes with the territory too, I'm afraid."

She sat alone at her desk in the empty classroom, inserting the CDs into the silent terminal one after the other. Again and again, she looked up at the vacant room, and felt the ache of a deeper emptiness inside of her. It wasn't right like this; wasn't right without the thick, delicious blend of raw humanity that the children had always brought to it. Wasn't right without the excited chatter. Without the electricity of small, eager faces. Well—perhaps they hadn't all been eager, but enough had been, and even the most sullen had never made her lose hope.

She'd thought it wouldn't hurt if she didn't think about it. But it hurt anyway. It was worse than watching the children under the link.

"Ms. Jiang?"

The voice almost made her jump out of her chair. She spun to find a small, furry face watching her with brown eyes. The semisimian features disoriented her for only a moment, however, though that it disoriented her at all by now was disturbing.

"Allison. What—what are you doing here?"

"Somebody told me you leavin.' Why you doin' that?"

Lisa closed her eyes and fought down the rage. Somebody—she could just imagine who—and how they would have enjoyed taunting a shimp.

No. That wasn't fair. It could have been anyone, for any reason. "Who told you that, Allison? Nothing has been decided yet." She regretted the clumsy lie immediately, especially once the girl started the long, mournful sobs that shimps were infamous for, and began blubbering about how Lisa was the best teacher she ever had. She held the convulsing form and decided to take a couple of those tranks the first opportunity she got. Maybe more than a couple.

By the time she finally got back to her compartment, a couple of hours later, she was feeling really depressed and exhausted. All she had ever wanted to do, since she was a little girl, was be a teacher. The struggles in her own schooling, first in college and the education school, had only sharpened those ambitions to crystal hardness. It had never occurred to her that she would ever be something else, would ever *have* to be something else.

Damn it, why hadn't she thought of that before!

She threw herself on her bed so hard that she didn't notice at first that there was an incoming mailicon on her terminal. When she did become aware of it she simply lay there watching the idiotic icon blinking back at her, and wondered what anyone could have to say to her that could possibly matter anymore. "What the hell," she finally muttered, rolled over and opened it with a touch of her finger.

"Dear Ms. Jiang:

"It is with regret that we inform you that your services as educator are no longer required by the colony. The termination of your employment for these services is effective immediately.

"We also wish to inform you that a new position with the title Coordinator for Developmental Methods is being created in the department, with a start-

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ing salary of 28.6K per annum. The individual in this position will be responsible for ongoing evaluation of the colony's educational needs and facilities, and will actively explore experimental methods and courses. Regular reports will be made to the board, with recommendations where appropriate. If you would like to be considered for this position, please inform the board as soon as possible. If you have any questions regarding the position, please do not hesitate to contact us.

"Thank you."

For a long time Lisa just stared at the screen containing the impossible words, reading and rereading them as though she must have misunderstood their meaning. But they stubbornly refused to alter themselves.

When she finally did accept them, she sobbed silently at the guilt that clawed at her conscience. It was irrational — only posterity could decide whether the end had been worth her means—but she knew, whatever came of it, that a part of her would never forgive her for having used the children she loved to reach the adults. That it was a burden she would carry for the rest of her life.

She sobbed for a while. Then, rising to the terminal, she started to compose her reply. ■

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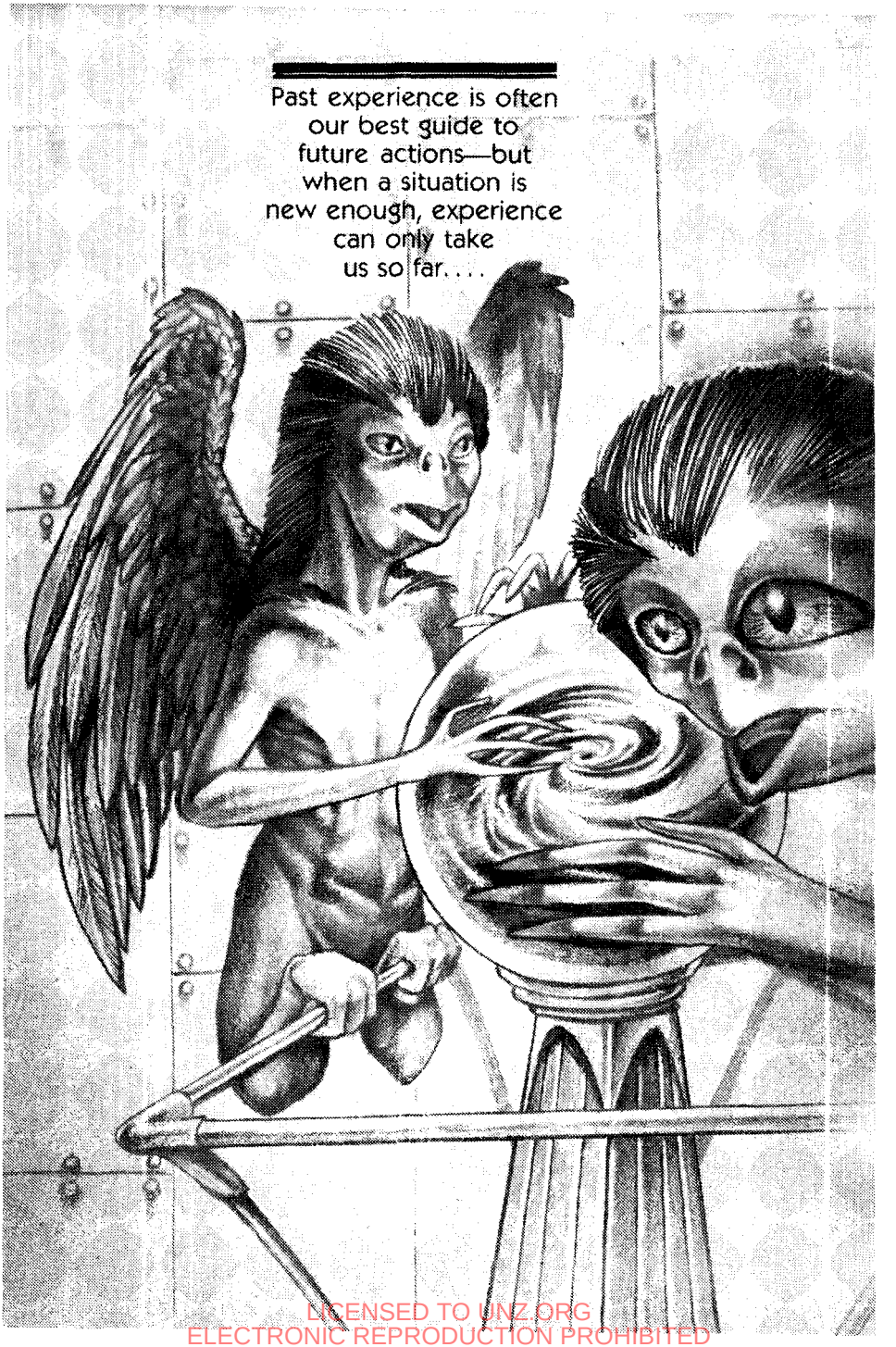
Past experience is often our best guide to future actions—but when a situation is new enough, experience can only take us so far. . . .

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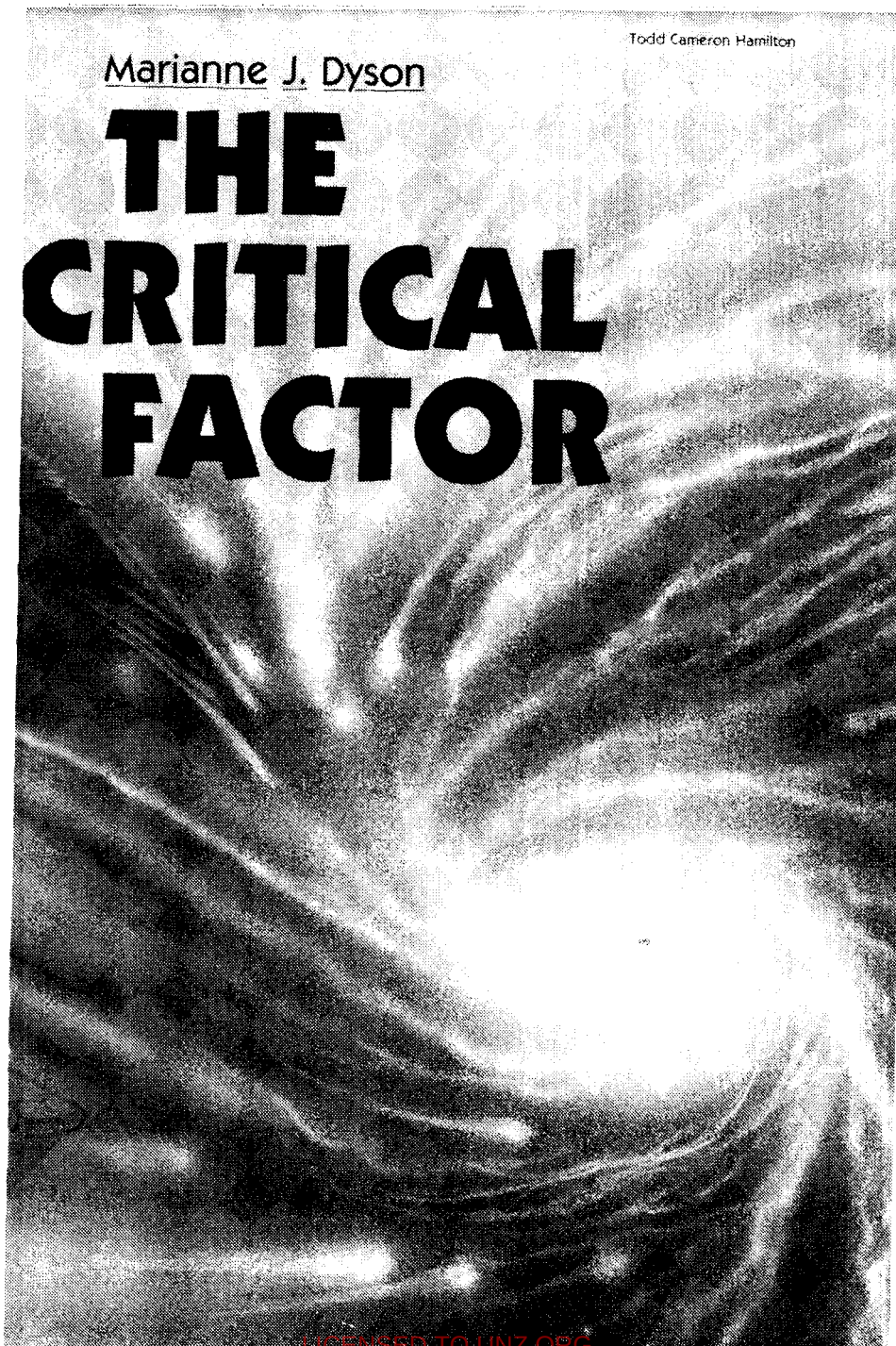
Marianne J. Dyson

THE CRITICAL FACTOR



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Instead of the life-giving shine of a yellow star, the ugly corpse of yet another smoldering, red dwarf reached the eyes of Trine. Recently awakened from conservation sleep by the ship's automatic systems, Trine rubbed his eyes furiously, hoping to dispel the reality displayed on the screen before him. As he watched, the once lively star seemed to cough blood-red spicules, offering a last gasp of energy in blessing to the small beings come to pay respects. Greedily, the ship's hull absorbed the radiation. But Trine feared it wouldn't be enough. Even in suspension the crew needed energy, and it would take all that was left of this old star just to feed them and charge the propulsion.

Trine looked at the star map spherical display which once had twinkled with the light of millions of stars within range of their ship. Now, like a console full of red warning lights, only the long-lived, low-luminosity dwarfs remained. All other types had burned out one by one. The universe was dying.

Trine ruffled small wings out of habit and placed hands over his face, weeping. All he had ever known would soon be gone, even the poor red dwarfs would be swallowed up in the collapse. Ever since their sun had flared and engulfed the planet of his ancestors millions of years ago, leaving only a few to escape to the closest star, they had dreaded this day. The ship was all that was left, and even the hope that they could somehow absorb enough energy to wait for a new creation seemed as dim and distant as the ancient light now reaching him from across the galaxy.

As long as they had energy, Trine's people could live forever, and he could pretend bravery and belief as he navigated from star to star with the crew in suspension. But with nothing but dwarfs left within range of their ship, still thwarted from crossing the barrier of light speed, he could no longer hide from the unknown course ahead.

Chest heaving, Trine's toes uncurled from the perch below the viewscreen, and he drew knees to a hairless chest. He couldn't face this reality alone.

Flapping his small wings, he entered the leader's holding room. Even with skin white as starlight due to the suspension, Yachem was magnificent to look upon. One of the originals, his wings were the color of a warm sun, his hair black as space. As his name implied, Trine was merely a third-generation clone, a copy of an original with standard olive skin and wings the color of a young blue star, for which they searched in vain.

Trine keyed the code to awaken Yachem. The light beams responded, illuminating the naked body held in place by straps at the wrists and ankles. The suspension field wrapped Yachem in light, warming him. Trine watched as the winged leader's skin darkened, absorbing energy directly to quicken his pulse, open his oval eyes.

Yachem's head turned toward Trine, and fingers groped to release the straps and turn off the light. As a leader should, he never allowed himself to indulge in the glow of a little extra energy, even though he knew as well as Trine that conserving those few extra ergs would not do much to change their situation. Yachem reached for Trine with still pale hands, and Trine blushed, ashamed of his own dark green color.

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He offered Yachem fluid, but he refused.

"You have awakened me, young one. What do you require?"

Trine felt awkward in the presence of the one who had conceived of the plan to survive through the collapse of the universe. He therefore said only, "Come," and gently guided Yachem to the navigator's station in front of the large viewscreen.

Yachem frowned as he gazed at the slowly dying fire of their last hope. They had journeyed a thousand light-years to reach this place, but the star they had targeted had evolved into this decaying nightmare even while they traveled.

Yachem cycled the map arrays, shoulders drooping, wings quivering in anticipation. At last he raised his eyes to meet Trine's. "You were right to wake me. The end is indeed near. Soon all the bodies of matter will be in collision."

Trine shivered and moved closer to Yachem, so that his shoulder brushed against the cool flesh of his leader. Both stared at the faint sun, which, like an ember among ashes, would probably continue to put out its feeble light until the long fingers of a black hole's night closed over it forever.

Cosmology taught that the universe had a beginning in a large explosion, billions of years ago, and that eventually it would collapse, and therefore have an end, at least locally. Even though Trine had done the observations that proved the fate of their sun had not been unique, that stars were no longer being formed, that the last supernova was only a memory of ancient history, he did not pretend to understand it. But Yachem told him he must keep trying. For the sake of those who had died because they had not understood. A whole planet of people who had been secure in their personal eternity.

Trine shivered again, remembering those first years when Yachem had nearly gone mad with grief and guilt over the destruction of his home planet—watching helplessly from his observatory on the outermost planet. Trine had been a lowly servant then, as all clones were to originals. He had never been expected to think for himself, let alone challenge a Master Cosmologist. But after the sun's death, all that had changed.

Yachem had insisted that Trine ask him as many questions as possible, and always take the opposite point of view in a discussion, saying this helped him come up with new ideas and solutions. Trine had not been as good at this as originals Yachem had known, but he had always tried to do his best, repeating ideas learned from study. It was his greatest hope that someday he might have a truly new idea of his own.

One of Yachem's ideas was the plan that had saved them so far: to enter a state of suspension, soaking up energy until it took more to gather it than was worthwhile, like the rays from red dwarfs. Then, with matter collapsing toward them from all directions, he planned for them to chart the Final Course, avoiding being yanked into one of the large attractors that would collect into the cosmic egg. Yachem assumed that at some point the egg would reach a critical density and explode again, creating a new universe.

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Another of his ideas was to skim the final event horizon, taking advantage of the nonuniform distribution of matter to be the last item absorbed.

But not even the esteemed Yachem, with his ancient wisdom, could predict how long they could resist the collapse. Trine remembered the questions he had been compelled to ask: Could they risk a swing-by of one of the attractors? What would it do to their energy and field equations? What value should they use for the ever uncertain dimension of time? No one could guarantee Trine would not wake to discover himself eternally dying as the ship crossed the event horizon of the egg's black death.

"Master, should we initiate the Final Course?"

Yachem turned golden eyes at Trine, a slow nod causing him to bob up and down in the weak spin field of the ship. "Yes, it is time. We must plot it together."

Trine took a deep breath, trying not to think of this as his last living act. Working almost on instinct, he quickly generated the appropriate spherical display, remembering how Yachem had praised him and another clone for their application of his idea to simplify individual masses with large gray balls representing centers of mass. He watched as Yachem analyzed the velocities of each major mass collection, estimating the time until absorption by an attractor, then each attractor to the others to form the egg. At Yachem's nod, he changed the coordinates of the sphere and expanded it so that Yachem was at the estimated position of the final mass concentration.

Trine remained silent as the Master Cosmologist examined the directions of motion, accounting for collisions between now dark objects whose positions were based on millennia-old observations. The course must not pass within the influence of these large masses, or they would be captured, then crushed or squeezed into an unknown dimension as cold dark matter, black holes, and the remains of burned-out stars fell one by one into a gravity well. A well so deep that only the force of a new creation could expel them from it.

Yachem drew a curving line in green light with the tip of his finger. The equation representing the curve was automatically entered into the ship's computer. Trine then suppressed the images of the mass centers, and generated the shape of the once smooth cosmic background radiation. From the outside, it appeared like a partially deflated ball, the pockmarks indicating those areas where the radiation, left over from the creation blast, had begun to fall back to its origin, like a projectile that had not attained escape velocity. The mass of the universe was pulling all its scattered seeds back to itself.

Trine now caused the deflated sphere to collapse, carefully watching the course line until it poked through the boundary. He stopped the collapse, and adjusted the projection from the outside, making sure the course traveled the path of least energy. Yachem adjusted it from the inside, making sure that the line remained just beyond the event horizon, the point where not even light could escape.

Finally, they were both satisfied, and let the computer determine at what point the uncertainty in the collapse rate

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would require Trine and Yachem to be awakened for a course correction. If they had enough energy, none would be required since they could just account for the uncertainty by plotting for the worst case. But if not, then they would have to refine the course to a minimum energy, which would require reducing the uncertainty through observations and incorporating these updates at regular intervals, something Trine, as Navigator, would be awakened to do.

The computer would have to iterate the course solution over millions of years. Trine waited impatiently for the response. Yachem surprised him with an offer to drink.

"We will soon sleep longer than ever before," he said. "We must load ourselves with fluid, so that minimal energy will be required to sustain us."

Trine nodded and sipped the clear liquid, feeling its coolness radiate throughout him. His wings fluttered in pleasure, opening slightly. Sensing Yachem was inviting conversation, Trine asked, "Master, do you think there are other beings in other universes who have done what we are doing?"

Yachem smiled. "I do not know, but I hope so. We only explored a very tiny piece of our universe, and though we encountered no other beings, it still seems hard to imagine that we are unique. Just as there were many stars, I think that our Final Attractor is but one of many."

Remembering a question on one of the cosmology tests, Trine asked, "But, Master, then why don't we see light from these other universes?"

Yachem affectionately stroked the top of Trine's head as he answered, "Because they also are expanding and collapsing, just like ours. Think of a universe as a super black hole, and ourselves hidden inside."

Trine twisted his mouth trying to understand. Yachem tried another approach. "Perhaps all the attractors are separated exactly so that they do not overlap one another in time or space, like you and your original."

Trine wondered what it would be like to be free of time's direction. "Do you think there could ever be a universe that is not bounded but finite? One that does not have enough mass to collapse?"

Yachem shook his head, causing his black hair to form a halo around his pale green face. "If such a universe existed, its first light would eventually reach us, first as a bright spot, then a deformation like that caused by two intersecting spheres. We have never observed such a phenomenon. Instead we see objects in all directions that are of a generation with us, meaning if we could travel there instantly, we would find nothing but red dwarfs, not the third-generation yellow stars whose light is just now reaching us. Remember, you yourself verified that there are no longer any supernovas or quasars."

Trine nodded. "But it could be that we have just not been observing long enough."

Yachem smiled again, obviously enjoying this exchange with a younger, still inquisitive mind. "That is true. We are young in terms of the age of even our own universe. Perhaps if we had unlocked the cage of mortality a billion years earlier, we might have observed the flash from such a thing."

Yachem stared out the viewscreen as

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if looking for a distant light that was no longer there, then continued, "Let us postulate that such a universe existed, and beings such as ourselves evolved there. What would they do once they discovered this fact about their universe?"

Trine inhaled quickly. He didn't remember the answer to this question, so he restated the question. "You mean that it would continue to expand?"

"Yes."

Trine tried to imagine himself in such a situation. He speculated out loud, as Yachem had taught him to do. "They would realize that their energy resources would get farther and farther apart, and eventually burn out. They would not have the option of waiting for a new creation." He indicated the viewscreen image. "Even the red dwarfs would use up their fusion sources eventually. Therefore, they would either die or . . ." Trine flapped his wings in excitement. "Or find a way to cross over to another, younger universe!"

Yachem nodded, and Trine could see by the shine in his eyes that he had reasoned his way to an acceptable, if not totally unique, answer. "Yes, and since the constant expansion would spread resources thin, they would have to spread out in all directions. It is likely that at least one other universe would intersect their expansion at some time."

Trine burst out, "It could even account for our own appearance in this universe!"

Yachem fluffed his wings and tilted his head to look at Trine from a new perspective. "If you could devise a test of this theory, it could qualify you for promotion to Cosmologist."

Trine smiled and bowed his head, proud but embarrassed. It was their people's highest honor to originate a new theory that could be tested, something a clone had never done.

The computer chose that moment to announce completion of their time plot. Yachem and Trine checked the figures several times, then embraced. According to the calculations, they had enough energy to sleep through the collapse plus a million years into the expansion, assuming the explosion occurred as soon as all the mass was within the event horizon.

Trine saw to it that Yachem was secured in his holding, then he attached his own wrist and ankle supports, and drifted into suspension, dreaming of blazing quasars filling the heavens once again.

Millennia passed, and the ship containing Trine and his people followed the course, maintaining separation from the accumulating masses that were gradually pulled to the Final Attractor. The event horizon and the boundary of the cosmic background radiation became one. When the last of the radiation spiraled into the singularity, nothing remained to use for a course reference, so the ship's computer awakened Navigator Trine.

Trine felt the warm glow of sunshine pulling him to wakefulness. He imagined himself basking in the light of a hot, blue sun. He smiled and groped for his wrist supports, eyes barely slits. His heart rate quickened with excitement. Had they arrived? Had the new universe been born?

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Trine hastily flapped to the viewscreen. His vision refused to cooperate though, and he was forced to take long, deep breaths. It came to him that the air was thin, as it was supposed to be when they were all in suspension. The ship should have adjusted the oxygen ratio before his wake up. A momentary panic seized him. Were they so low on energy that it couldn't? He breathed deeply again and his eyes finally cleared. No, the air was fine now. He'd just rushed things too much. His skin hadn't even had time to turn green.

He decided the viewscreen had simply failed. It couldn't be that the universe was a black void. He entered the time of his last waking and had the computer show him how the universe had actually collapsed, compared to what Yachem had predicted. The Master had been amazingly accurate. In fact it appeared his only mistake was underestimating the density of some of the dark matter contributions. Therefore, the universe had collapsed at a slightly higher rate than predicted. By now it should be on the way to producing quasars, but it hadn't re-exploded. Trine rushed to awake Yachem.

Soon Yachem had also replayed the collapse, convincing himself that the model had been accurate in all but the smallest details. He then had Trine create a model of the Final Attractor. Since they had no way to probe beyond a horizon they could no longer define, they assumed a perfectly spherical ball of mass, with their ship creating a minutely thin gap between the universe's horizon and the Final Attractor's horizon. The two of which would become one as soon as their ship ran out of energy.

Yachem ran his hands over the image, as if stroking one of his lovers, hoping for a reaction. He drew lines with his fingers, twisted them into strings, pinched them, and hurled them at the singularity.

But the ball remained spherical, unchanged.

Yachem signaled for Trine to discontinue the image. He grasped both of Trine's hands and stared as if trying to read Trine's thoughts by studying his face. Finally Yachem's eyes overflowed with emotion. He whispered, "It is stable."

Trine had not seen such emotion on his master's face since the destruction of the home planet. "Stable?"

"This is no time for questions! I said stable!" Yachem shouted, face changing colors, wings flapping erratically.

Trine placed a hand on his leader's shoulder. "Master, please, you must calm yourself. You will waste precious energy becoming angry."

Yachem glared at Trine, then nodded, wiping a hand across his brow. "Forgive me. I am but one person, and could not think of everything. I made an assumption, one that was obviously wrong. I assumed that since the mass of the universe was sufficient to cause the initial bang, that once it collapsed again, it would have to re-explode: like the critical mass of a nuclear explosion, or the critical density of a star that goes supernova." He pointed to the black viewscreen. "But it is stable! Perfectly stable!"

Arms circled one another as Trine pressed his chest against Yachem, like he used to do in the first years after

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the destruction. Now he understood the consequences of this discovery—they would eventually run out of energy and die while the universe remained dark and folded in upon itself.

Trine felt the hope draining out of him, and limply released his hold on Yachem. Falling into old habits of taking the other side of an argument, Trine mumbled, "There must be a way to make it unstable."

Yachem, who hovered in front of the viewscreen, eyes unfocused, jerked as if Trine's words had struck him a physical blow. He grabbed Trine by both shoulders so strongly that it hurt. "Did you say make it unstable?"

Trine squirmed out of Yachem's grip. "Yes."

"Yes," Yachem repeated. "Yes! It must be our mass that is the critical element needed to start the bang!"

"But Master, you yourself have said that our mass is so insignificant, it cannot matter to the equation. And if we throw ourselves across the horizon, we will surely die!"

Yachem turned to Trine angrily. "We don't know that. And waiting, we die anyway, and the universe also dies! We cannot escape the time dimension."

He moved to the life support station. "I will awaken the crew. We will spend our last hours together."

Trine stared dumbly at Yachem, his master, his only true friend. When the home planet had been consumed, Yachem had suffered almost to the point of death at the loss. Trine and the other clones, who had been made at and had never left the outpost, had experienced the grief secondhand, like friends of a family whose loved one was killed by accident.

But this time was different. This time Trine felt a choking sensation in his throat, an overwhelming need to hold Yachem against him. He flew recklessly at his leader, knocking him against the control panel. "Wait!" he shouted. "This can't be the end! I won't let you die."

Yachem rotated in Trine's grasp, his face a mixture of query and hope. "You have an idea?"

Trine tried to think. The emotion in him was so strong it was like being heated on the inside. He took a deep breath, trying to cool the flames. He must use reason to deal with problems, as Yachem had taught him. "It is not logical that our tiny mass could be the missing element."

Yachem gently pulled Trine to rest next to him on the console. "Continue."

"But we know that something made the egg explode at least once. Therefore, there is a factor we are overlooking."

Yachem's eyes glanced at their low energy reading. Within the next few hours the thin shell of their existence would collapse onto the event horizon, like an atmosphere condensing onto a planet's surface. The thought gnawed at Trine, deep inside. His hands started shaking and his heart beat as if it would explode from his chest. "Master, I cannot think, something is wrong with me!"

Gently, Yachem stroked Trine's face. "It is fear, my favorite one. Fear of death, of the unknown. Do not let it consume you. Think of the critical factor. What have we overlooked that

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would make the egg unstable?''

Trine shook his head, rubbing his own temples. Memories flashed through his mind in fast succession, stopping at the last waking. ''Master, remember when we discussed how an expanding universe might intersect our own?''

''Yes.''

''That would surely provide an instability.''

Yachem shook his head wearily. ''Perhaps, young one, but we will not last long enough to wait for one.''

Trine focused on the problem, releasing his fear of death like holding straps. In his subconscious, an idea was forming. ''No! We don't have to wait. They have already been here!''

Yachem gave Trine a puzzled look. ''You are not making any sense, Trine. If they are here, then why is the egg stable?''

Trine burst into a full grin and embraced Yachem. ''Because we are their last surviving descendants. We are the critical factor. Not our mass, but our life force!''

Yachem pushed himself back. ''But as you said, as we cross the boundary, we will die.''

Trine's mind was racing so fast, he had to struggle to speak clearly. ''No, we won't because they didn't. Life always existed. We have maintained it, passing it from old to new cells, like the ancients passing flame from stick to stick. But we have never created it simply from the chemical elements.''

Yachem nodded, stroking his chin. ''It is true that, like gravity, we have only been able to manipulate life without knowing its true nature or source.''

''Exactly. And the reason is that life itself was not part of this universe. The beings from an expanding universe, in search of energy, filled with the need to survive, entered our black hole egg hoping to find energy within. The egg exploded, creating our universe.''

''Yes,'' Yachem answered suddenly. ''The theory is consistent with observation and offers a prediction, and a hope.'' The slits in his golden eyes grew wide and black with emotion. He heartily embraced Trine. ''You have proven my theory that clones, given enough practice asking questions, will come up with new ideas of their own. I am so proud!'' Trine thought if he cried any more this day, he'd have to drink again, but he had never been so happy.

''Your theory is worthy of your promotion to Cosmologist. You shall no longer be Navigator, but henceforth Cosmologist Trine. And we will test this Creation theory. I will awaken the crew, and we will cross the horizon without fear.''

Trine struggled away. Another thought emerging from his subconscious. A warning of danger. ''No, Master. Not all of us. Just me in a lifeboat.

''It is likely that I will lose my identity as I transmit my life to the egg. Let us not lose all that we have learned. I can be replaced with another clone, but you are an original!''

Yachem hugged him closer and whispered, ''Never think that you can be replaced. You may have the same genes as your predecessor, but you are indeed unique, as you have just proven.'' He brushed tears from his eyes. ''I will miss you as much as I miss the home planet.''

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They each unfolded a wing over the other's head, a gesture of deepest affection. Even though it might mean his own death through the loss of his memories, Trine knew deep inside that he had made the right decision. And to be promoted to Cosmologist! He could not stop the flood of emotion that rushed through the canyons of his soul to burst forth and flow from his eyes.

Yachem let Trine select a new navigator. He chose the clone who had helped him design the universal model. Yachem joked that this clone asked almost as many questions as Trine, and was therefore a good choice. They awakened him, and when Yachem explained the situation, the clone offered Trine a drink, like a servant to a master. As he accepted, Trine tingled with excitement, knowing his promotion would provide proof to all clones that they were as good as the originals from whom they were copied. Even if he was wrong about life being the critical factor, the others could face the horizon crossing with hope and dignity.

Before Trine could have time to lose his courage, the three of them hugged, and Trine climbed bravely into the lifeboat.

Trine wasn't sure which direction to go since there were no references now, so he selected a velocity vector at a right angle to the one of the main ship. Trine watched the ship shrink to a tiny dot on his viewscreen, then disappear.

As time passed, Trine began to doubt. Maybe Yachem hadn't believed his theory at all. Seeing Trine filled with fear, he let him indulge in grasping at hope, like the rays of a red dwarf, unable to really save him. Promoting him to Cosmologist and then allowing him to feel that he was somehow sacrificing himself for a purpose, rather than dying an inevitable death. Beings from another universe? Had he been serious?

Trine considered returning to the ship, but realized he couldn't. It would take away the hope that he had given the others. No, he would face death alone.

It was many hours later when suddenly the blackness was pierced with flashes of light, so intense that Trine could see them even with his eyes squeezed shut.

Since he had spent all his life inside a black hole the size of the universe, it wasn't the thought of entering a black hole that scared him, but the transition, like a waterfall with water flowing easily on either side, that brought the fear of death. The flashes increased in frequency like rapids before the fall.

He felt as if gravity was pulling his feet and head in opposite directions at once, spinning him in a whirlpool of fields. The fluid he had recently drunk was squeezed out through his skin like someone compressing a sponge, causing his temperature to rise dangerously. Surely death was not far into his future.

The boat systems chimed warnings that the hull was being saturated with energetic particles. The navigation system indicated there was no horizon, all directions being sensed the same. Trine discounted its objectivity anyway, sure that the hull was magnetized and ionized since he was surrounded by a swirling mass of glowing plasma. His temperature continued to rise, and he felt pain for the first time in his existence. He jolted in and out of consciousness, each time wondering if he had died.

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When his temperature rose enough to trigger the ship's computer, it sprayed him with fluid. Trine startled awake, disoriented and confused, wondering where the light was that was burning him so much, groping to disconnect nonexistent straps.

Once aroused, it occurred to him that perhaps he had just witnessed the birth of the universe, but then, how could he still be alive? He had expected to be torn to pieces, having his life force distributed throughout the egg the way cells were used to grow new clones. He imagined Yachem in his mind, taking the other side of the argument. He would remind him that to be valid, a theory must match observation.

He had caused the explosion. Of that he was fairly certain. Could his tiny mass really have done it? What else about him might be the critical factor? In his mind he saw himself telling Yachem he wouldn't let this be the end, he wouldn't let him die. He heard Yachem reminding him to think, that through thinking we survive. Thinking. Could that be the factor? Could thoughts provide a fluctuation that is somehow amplified throughout the egg, leading to the explosion?

Trine remembered a theory he had studied long ago on the nature of thought. The philosopher had postulated that a thought was somehow a collapse of the quantum mechanical wave function to a specific state. He further postulated that unlike someone putting their finger in running water to reduce the temperature possibilities to one value, in the presence of enough space-time curvature, probabilities are reduced to an actual state without need of an observer. The other philosophers dismissed it as so much wing flapping.

Trine smiled. It might be as crazy as his idea of beings from another universe, but right now, it made as much sense as the ancient idea of heaven. Suddenly he laughed. Maybe that's where he was!

Trine shifted in his small ship, noticing the smell of his sweat, feeling the dampness of his skin. No, this wasn't heaven. No one is alone in heaven. Alone? If he had crossed the horizon intact, then Yachem and the others could also!

Trine frantically scanned around him, but the navigation system indicated no collections of mass and the viewscreen showed only an even glow. Maybe they hadn't made the crossing yet, or maybe for them time was in limbo—as they fell toward the egg, the egg expanded, trapping them on the horizon.

Trine felt that burning in his throat again. Why hadn't he thought this through more thoroughly before leaving? He should have listened to Yachem instead of insisting that somehow he could save them. Then they would have all crossed together. This new universe was hell, that's what it was. Eternal separation from all that he loved! He would rather have died!

After hours, or days, with no sense of time other than periods of sleeping and waking, Trine abandoned any hope of locating the ship. With the rapid expansion, even if they had entered near one another, by now they would be light-years apart, like dots expanding on the surface of a sphere, and the tiny lifeboat could never store enough energy to cross such an expanse.

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Trine dwelled on thoughts of the past, returning to his earliest memories back at the observatory, the days after the destruction of the home planet, and the time Yachem had nearly killed himself.

But he hadn't. Instead Yachem had told them all that life was sacred, that it must be passed on, and they had an obligation to continue to survive.

They had never found life elsewhere in their universe. They had hoped to find life based on other chemicals, or life originating on another nearby world, but had not.

Now Trine had proof that they had been alone after all. For if life had been spread throughout the universe, the egg would not have waited for him before exploding. Otherwise, his life, or his thoughts, or spirit, or whatever could not have been the critical factor.

No matter how it had happened, Trine was alive, and he had inherited the obligation to survive. At some point, the universe would produce stars and planets, and Trine would have energy and water to make a clone. "No," he thought, "not *a* clone." In order to increase the gene pool through evolution, he'd have to make both a male and female clone. He put himself in suspension, setting the computer to wake him as soon as it encountered the energy signature of a home star.

Trine's lifeboat accelerated through space, pushed outward from the Final Attractor by the force of the explosion, then pulled gently by gravity into the bosom of a newly forming galaxy. At last the light of a young, yellow star, the color of Yachem's wings, formed in a swirling gas cloud. It shone on Trine's boat, signaling the computer to wake him from suspension.

Trine opened his eyes and studied the viewscreen. He gasped in awe and satisfaction as the heavens once again displayed the light of quasars. There was evidence of a supernova in a nearby cluster.

But Trine's attention soon focused on one planet orbiting the star. He knew at once that Yachem would have loved it, and this thought brought tears to his eyes. It sparkled like a jewel, blue and white and brown like the home planet, only bigger. He ruffled his wings, realizing the increased gravity would make them useless.

Before descending to the surface, Trine scanned in all directions, a last unobstructed view of the heavens. The universe was old enough that the first light had been scattered and cooled so that he should see the same radiation in all directions, cosmic background radiation, hotter than in his old universe. Trine gasped in excitement as the background radiation plot appeared before him. There was an anomaly! A "hole" as if something had absorbed the energy. Was it an intersecting universe, or a signal from Yachem?

Trine realized he might have to wait a long time to find out the answer to that question. He smiled. Perhaps he wouldn't be the one figure it out.

Like Yachem had done for him, he would teach his clones to ask questions and think. Someday, they would create a new universe of their own. ■

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the reference library

By Tom Easton

A Bridge of Years, Robert Charles Wilson, Foundation Doubleday, $20, 334 pp.
The Garden of Rama, Arthur C. Clarke and Gentry Lee, Bantam, $20, 442 pp.
Red Orc's Rage, Philip José Farmer, TOR, $18.95, 278 pp.
Mirabile, Janet Kagan, TOR, $18.95, 278 pp.
The Dark Beyond the Stars, Frank M. Robinson, TOR, $19.95, 408 pp.
Grounded! Chris Claremont, Ace, $4.95, 325 pp.
The Year's Best Science Fiction, Eighth Annual Collection, Gardner Dozois, ed., St. Martin's, $27.95, 624 pp.
Gravity's Angels, Michael Swanwick, Arkham House (Sauk City, WI 53583), $20.95, 302 pp.

Robert Charles Wilson began with a bang a few years ago and has gotten continually better. This is what readers hope of new writers, and when they get it, they can show immense loyalty. It is also what writers hope of themselves, for reader loyalty is what makes a successful career. Just ask Stephen King.

Remember *A Hidden Place*? *Gypsies*? *The Divide*? *Memory Wire*? Then you must be looking forward to Wilson's latest, **A Bridge of Years**. If you are, let me assure you that you will not be disappointed. Wilson's hand is as sure as you could wish as he paints the northwestern town of Belltower, where there is an ordinary-looking house inhabited by a reclusive time traveler, Ben Collier.

In this much, *Bridge of Years* bears a certain kinship to Clifford Simak's classic *Waystation*, even though Simak was talking about travel in space, not time. Still, Wilson doesn't really depart from that kindred novel until he supposes that the Waystation could be subverted and abandoned, and that it could then fall into the hands of an ordinary person.

In April 1979, a soldier deserting from the next century comes through Wilson's time tunnel, kills Ben, and flees further into the past. Ben's nanomachines carefully preserve his body and begin the long, slow job of reconstruction and revival. Meanwhile, the house goes to the town for unpaid taxes.

In 1989, Tom Winter, having recently lost both his wife and job and failed to find happiness in the bottom of a bottle, buys the place and discovers mysteries. The nanomachines, you see, are still there. They keep the place clean. They even wash Tom's dishes. They send him messages on his TV screen and in his sleep.

And then he discovers the time tunnel in the basement. The other end is in 1962 New York. Tom is tempted by that simpler time when, despite all the troubles ahead, he would have the comfort of knowing for certain that there would be no nuclear war for the next three decades. He finds a girl in Greenwich Village, already waning as a kingdom of hippies. He settles in, happy.

Meanwhile, that deserter is still around. Every so often, the needs impelled by his symbiotic battle armor drive him to kill. He learns that someone has used the tunnel. He is fright-

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ened, angry, desperate, and looking for Tom Winter.

Meanwhile, back home in 1989 Belltower, the elderly neighbor lady has died. Her niece and heir has discovered a decrepit shed in the woods and opened the door to find a body—its skin transparent, a leg missing, looking raw and incomplete and ruined—that says "Help me." She summons Douglas Archer, the realtor who sold Tom Winter Ben Collier's house, and together they find out what is going on.

It gets spooky at times. It's also romantic, sympathetic, suspenseful, and full of marvelous notions about both the present (we really must accept it) and the future (from the Storm Zone spawned by the Greenhouse Effect to the ever-so-distant descendants of humanity who built the time tunnel in a crack in the very structure of space-time).

I enjoyed the book tremendously. I expect you will too.

The third book in the series begun by Arthur C. Clarke's *Rendezvous with Rama* is now available. It is, as promised, **The Garden of Rama**, by Clarke and Gentry Lee, and it is rather less charming than the second, *Rama II*.

The story thus far: The original Rama was a huge, cylindrical spacecraft barreling out of interstellar space toward our Sun. Astronauts mobilized to investigate learned that it had no crew, though a host of automatic machinery, including robots or biots, seemed to be waking up as Rama neared the Sun and warmed, and left. So did Rama. Decades later Rama II came back, to be visited by a second set of astronauts, who discovered strange life forms aboard. When the ship left the Solar System, having survived an attempt to destroy it with nuclear missiles, Nicole des Jardins, the devoutly religious General O'Toole, and scientist Richard Wakefield were aboard. There were signs that the Raman mission is to bait, trap, and collect sentient life forms.

And now we find that those signs were dead on, although Clarke and Lee take an unconscionably long and dreary time to tell the tale. Nicole has married Wakefield. They have children. They survive the frustrations and perils of life on Rama as the immense craft accelerates toward distant Sirius, where it finds a base of colossal proportions, the Node; the humans are studied in intimate detail, and in due time the Raman mission is explained. Then it is time for Nicole and Richard, older and greyer, with some of their children (a daughter marries O'Toole and remains at the Node), to return to Earth's vicinity to collect a sample of humans for further observation. The humans will inhabit a section of Rama designed for their comfort, with every need provided.

Sadly, the human sample proves far too representative of the species. Greed and power-hunger quickly appear. There is skullduggery and violence and intrigue. Humans break into a second enclave on Rama to find weird aliens. There is war. The Ramans gain as thoroughly unvarnished a view of humanity as any alien researchers could wish to have.

Clarke and Lee make an exceedingly pedestrian team of writers. They dwell far too much on daily details and the solving of small problems rather than on matters that move the story forward. In this, perhaps, they remind us of Jules Verne, who likewise gained verisimilitude by attention to minutiae. They also commit the cardinal sin of making both their characters and their readers little more than spectators at events. They bore their readers, and they bore them

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worse with an overemphasis on mysticism, memory, and maundering soliloquy.

Nor does it help that the grabby Earthlings are an obvious put-up designed to move the plot toward where the authors want it.

I wish I could recommend *Garden of Rama*. It has a distinguished, beloved senior author. It has scope and sweep and grandeur. But it has far too little life.

I'm looking forward to the next in the series (*Rama Revealed*) even less than I was after *Rama II*.

Philip José Farmer owes a fair measure of his fame to the five-book World of Tiers series, based on the notion of immortal Lords whose ancestors made a host of pocket universes (including ours) and then lost the technical skills to make more. Their descendants war over the existing pockets, one of which contains a world shaped like a ziggurat, which gives the series its name. Not surprisingly, fans have wished for many years for a sixth book in the series, and perhaps even for more.

Now Farmer offers us **Red Orc's Rage**, which may or may not be that sixth book, depending on how you take it. Certainly, if it were a short story or novelette, it would have fit into Mike Resnick's anthology of recursive SF, *Inside the Funhouse* (reviewed last month), for it discusses the series, uses the series, and reveals the series' link to the works of William Blake.

The story begins in our own real, nonfictional world, where a psychiatrist, A. James Giannini, has devised a therapeutic approach to mentally disturbed adolescents using the World of Tiers novels. In this "Tiersian" therapy, described in Giannini's Afterword to *Red Orc's Rage*, the patients read the books, choose a character, and then project themselves into the mind of that character. The idea is to replace their own internal fantasy worlds, to which no one else can have any meaningful access, with the fantasies of the novels, thus putting themselves and their therapists on common ground. Giannini says this gives the therapist "the metaphorical means . . . to conduct work onsite."

I find this very interesting. For one thing, it is a sort of reversal of something young science fiction and fantasy fans have done for generations, replacing a baffling, frustrating external world with shared fantasies. For another, once Farmer heard of Tiersian therapy, it led directly to *Red Orc's Rage*.

The novel's extraordinarily striking opening line, "Jim Grimson had never planned to eat his father's balls," sets the tone of archetypical conflict. Jim is a grim son indeed, and his drunken, unemployed, abusive father is even grimmer. The stage is instantly set for an Oedipus Rex. But before any Lords can make an appearance, Farmer must show us Jim's life as a teenaged troublemaker—not a hoodlum, but definitely wild, taking drugs and getting into deep shit indeed. The father-son conflict explodes into rage, and Jim winds up in the local mental hospital, in the hands of a Tiersian therapist.

As the book's title hints, Jim is soon projecting himself into the persona of Red Orc, a youth with a father as abusive as Jim's. He is also as full of rage, but when his father banishes him to a deserted world of deadly monsters, he demonstrates that he also has considerable competencies.

Is Orc's world "real"? It feels that way to Jim, even though he knows it's supposedly just fantasy. It may feel that way to the reader too, in which case we

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could justify calling the novel the sixth member of the World of Tiers series. But whether it is real or not, it serves its purpose. Jim learns, recognizes the parallels between himself and Orc, and improves his self-image. When he eventually learns to reject the worst of the parallels—the rage and lack of control—he becomes mentally healthy enough to leave the hospital.

As Giannini says in his Afterword, "The novel . . . while short on absolutely accurate detail faithfully reproduces the sweat and fire of scientific enquiry . . . the intuitive 'feel' of psychotherapeutic treatment. In it, we can truly experience Jim's emergence into reality as he takes control of his own life."

Farmer's work is always interesting. Here he is more interesting than usual. So go forth and buy and read. And then ask yourselves: Are there any other SF books or series that might lend themselves to similar uses?

I was so delighted by Janet Kagan's **Mirabile** that I have no qualms about echoing editor David Hartwell's words: ". . . a playful hard science novel . . . achieved with . . . panache . . . artfully breezy and deuced clever." He assures us as well that "A lot of effort went into getting the science right or plausible, but in the end, it's all in fun."

Mirabile is a world to which have come human colonists in several generation ships. The humans brought an extensive stock of frozen embryos of "Earth-authentic" plants and animals. In the interests of efficiency, genetic engineers back home took advantage of the large amount of "non-coding" genetic material in most genomes to conceal the genomes of other organisms. Under the right environmental conditions, these passenger genomes may be activated, so that a cow can give birth to a pig, or a daisy to a mosquito. Unfortunately, unspecified disasters en route to Mirabile lost the stored knowledge of how to control this process and uncontrolled genomes have tendencies both to fail to breed true and to mix, producing strange hybrid "Dragon's Teeth." Fortunately, technology has given the colonists the means to analyze a genome instantly and determine whether it is Earth-authentic or Dragon's Tooth. It is the task of the "jasons," led by Annie Jason Masmajean (professions are stated in middle names) to so determine and then to decide as well whether an organism is useful or essential, sheer nuisance or threat to survival. Mosquitoes, no matter how authentic, have got to go. Odders and Loch Moose monsters can stay.

Say what? That's right. Loch Moose monsters, and the kangaroo rex, and the frankenswine. Three of the tale's six episodes, unified by the developing romance between Mama Jason and Leonov Bellmaker Denness. Both of them rather older than the stereotypes of romance encourage us to accept easily, focus on Dragon's Teeth, one benign, one scary but useful given the local ecology, and one a potential disaster to both humans and native lifeforms. A fourth considers the need for insectivores to control such things as mosquitoes. Two consider Mirabilan threats that neatly fit their own ecosystems and threaten humans until the jasons find a way to adapt to their presence (Kagan rarely—but not never—agrees that it is appropriate to wipe a species out).

As a biologist, I'm skeptical about the idea of nested genomes, even though viruses may nest among our genes and there are such things as genes embedded within other genes. But this idea is what makes much of Kagan's

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story possible. The rest of the science is right indeed, and it allows Kagan to give us a very sensible, unsentimental, tough-minded acceptance of the interconnectedness of nature. There are also a pragmatic approach to parenting and characters who, no matter what their age, have unusual amounts of wisdom. And Kagan presents it all with immense doses of charm, wit, and verve. You will enjoy this one.

It's not news that Frank M. Robinson and the late Thomas N. Scortia once wrote *The Glass Inferno*, which was later filmed as *The Towering Inferno*. More to the point here is that long before that Robinson had also written classic SF (*The Power*, 1956), and now he's back again with a marvelous saga of space exploration gone awry, **The Dark Beyond the Stars**.

As the tale opens, an unnamed fellow in a spacesuit is falling from a cliff on some lifeless alien world. Rescued just short of death, he awakens in what seems a spit-polished medical ward. The patients with whom he shares the ward, however, do not recognize his existence. Nor does he remember anything about his past. Before long he is told his name is Sparrow and he is aboard the *Astron*, a generation ship in quest of extraterrestrial life. But he soon learns how to use a "mask" to see past the holographic illusions and learns that the polished, crowded ward is in reality a greasy, grimy cubicle, empty but for him. The ship is showing its age. It has been in space for two millennia without finding any sign of life. And the mad captain, who has been the captain ever since launch—yes, he is immortal—is now about to venture into the Dark, a gulf of empty space across which lie clouds of older stars and perhaps a better chance of finding the expedition's goal. Unfortunately, it seems unlikely to any rational mind, such as Sparrow's, that the ship or its crew will survive the crossing. Two of its three cylindrical hulls are abandoned. Equipment is decrepit, worse kept from collapse only by cannibalizing worst, a process that is very near its limits.

This is not the sort of generation-ship tale that Heinlein and others have told, in which the memory of origin and mission is dim and the crew has descended into savagery to some degree. Thanks to an immortal captain and long lives even for mortals, this crew knows what it is up to, and its skills are sharp. The kinship with the classics is one of inversion, for here it is the captain that has turned savage, and evolution is biological instead of social. And ruin lies ahead unless the crew can mutiny successfully.

What is Sparrow's role? Someone tries to kill him. He finds no record of the planet where he nearly died in the computer. He does find a stage set that matches that planet. He learns that he has lost his memory many times, once each generation; he is the ship's "icon," its reminder of what a true Earth human is really like. He is befriended by the captain and drawn into the mutiny. The mutiny gathers momentum, even though the majority of the crew are incapable of violence, the result of a deliberate and surreptitious attempt to breed a crew the captain cannot command (two thousand years, a hundred generations; that's time enough for selective breeding to make a noticeable difference). The captain moves to crush the mutiny, and Sparrow narrowly survives his savage punishment of selected mutineers. He . . .

Enough. Not all the revelations are surprising, but Robinson's uncovering of the truth is slow and methodical, in-

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genious and satisfying. This is one of those rare books that would lose no money if it came with a double-your-money-back guarantee.

Chris Claremont's **Grounded!** is the sequel to her *FirstFlight*, in which industrialist Manuel Cobri opened the way to the stars and fledgling astronaut Lieutenant Nicole Shea defeated a pack of human pirates, made a successful first contact with the alien Halyan't'a, and has even been adopted by a high-status Hal clan. Her experiences left her injured and shaken. Now, physically healed, she remains uncertain, readier to hold back than to plunge into the fire once more, and NASA's shrinks declare her unfit for flight. She is grounded.

Not much worse can happen to someone with as much of the Right Stuff as Shea has displayed so far. Yet she doesn't even know whether she should see it as so awful, which is perhaps a sign that the shrinks were right. Until she decides, NASA is keeping her busy, assigning her to Edwards Air Force Base, where a Hal crew from her adopted clan is working with human engineers to blend Hal and human technology. One of the Hal has even been genetically tailored to think and act as much like Shea as an identical twin.

On her way there, flying an antique prop plane, she is nearly killed by a remotely piloted drone. At the base she finds that the drone belongs to Cobri's son, Alex, a genius so afraid of risk that he has developed a kind of virtual reality that allows him to do anything he wishes in simulation; the drone is an aspect of this. Soon thereafter, she meets Alex's sister, Amy—younger, greedy, manipulative. And when Alex begins to court Shea, Amy gets just a little bit annoyed.

Meanwhile, in space, investigators are trying to learn just who was behind those pirates, and the possibilities are limited. In fact, there's really only one: the Cobri megacorporation. Yet the connection cannot be proved. While Shea is summoned secretly to orbit to be told this much, a secret service agent occupies her home, pretending to be her. When the agent dies, Shea returns home to find, with her Hal think-alike, that her home has been wired as a giant virtual reality generator, apparently in order to program Shea to assassinate the President. The agent, exposed to the programming, died of a heart attack. And now both the Hal and Shea have been exposed.

The modern reader knows that the President is safe. The mystery lies elsewhere, for though "villain" has to be spelled "Cobri," there is so far no telling whether it is father, son, or daughter.

Claremont's tale has plenty of momentum right from the start. It moves right along, and it fills in just enough of the background on the run to make sure the reader doesn't have to have read *FirstFlight* (though it would surely help). There's action, danger, a bit of romance, a fair ration of derring-do, and all the satisfaction of watching Shea recover her grip on the Right Stuff. There may even be enough of all this good stuff to compensate for characters who are not really very satisfying. Shea herself comes straight from astronaut folklore, albeit she is female. The Cobris you have seen a thousand times before. And the Hal spend much of their time standing against the wall as ornamental spear-carriers.

Logic seems the weakest point. For one thing, there is no truly valid reason for Shea to go booming off to orbit for a half-hour conversation other than to let her double get killed; the message

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could be passed on paper a lot cheaper and faster if the point is to keep it out of computers that may be all too compromised. For another, the touch of New-Agey twin-telepathy between Shea and her alien think-alike does not convince. And neither of these weaknesses is essential to the plot. Claremont could surely have managed quite nicely without them.

So—if logic matters to you, avoid this one. If it doesn't, have fun.

There doesn't seem to be much competition for the "Best of the Bests" title this year. Donald A. Wollheim is dead, and his book won't be out. But Gardner Dozois's eighth **Year's Best Science Fiction** is now available, and it is as massive (250,000 words) a compendium of fine reading as ever. It contains the Dozois view of the best short SF of 1990, with ten of 25 selections from the magazine he edits, *Isaac Asimov's SF Magazine* (and one, Nancy Kress' "Inertia," from *Analog*). The contents include James Patrick Kelly's "Mr. Boy," Ursula K. Le Guin's "The Shobies' Story," Charles Sheffield's "A Braver Thing," Kate Wilhelm's "And the Angels Sing," Joe Haldeman's "The Hemingway Hoax," and more by Bruce Sterling, Terry Bisson, Lucius Shepard and Robert Frazier, Molly Gloss, John Kessel, Michael Moorcock, John Brunner, and Pat Murphy, among others. The great mystery story is Dafydd ab Hugh's "The Coon Rolled Down and Ruptured His Larinks, A Squeezed Novel by Mr. Skunk"; it posits a genetically engineered plague that raises animal and lowers human intelligence and fractures the language in ways that make sense only if you assume the animal characters can read; it has also drawn a large amount of admiring attention, although I fail to see that it is more than cute.

The book also contains the usual rapid "Summation" of the year in the worlds of magazine, book, and film SF, as well as a list of "Honorable Mentions."

Arkham House is still honoring the best in the field with collections of their shorter work. The current honoree is Michael Swanwick, whose **Gravity's Angels** presents his first published story, "The Feast of Saint Janis," and the equally memorable "A Midwinter's Tale," "The Blind Minotaur," "The Transmigration of Philip K," "Covenant of Souls," "The Dragon Line," "Mummer Kiss," "Trojan Horse," "Snow Angels," "The Man Who Met Picasso," "Foresight," "Ginungagap," and "The Edge of the World." If you never saw them in their original appearances, grab this chance to see them now. If you did, you know they are all worth reading again. ■

●Beware of the Truth. If you find a Truth, it can demand that you make painful changes.

Frank Herbert
(Submitted by Chuck Moore)

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Randy Asplund-Faith

REHAB

Eric Vinicoff

No test measures only one variable, and no course teaches only one lesson. . . .

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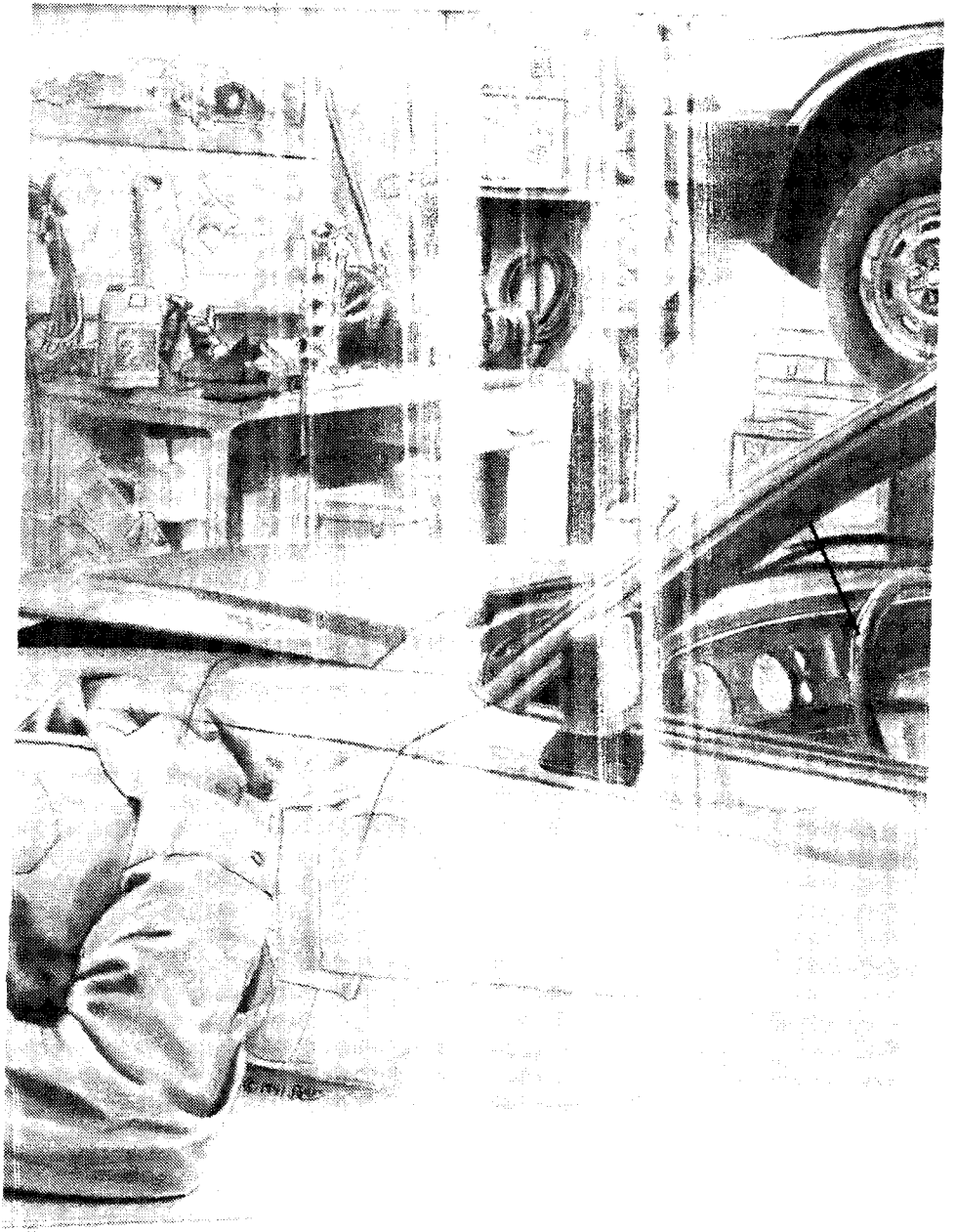

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Bloods initiation. Seventeen-year-old John Grace was the virgin.

John stood in front of the chips rack, pretending to pick a bag while he checked out the mom-and-pop. It was empty except for the old guy behind the counter. The wall clock said 8:15 P.M. Rain rattled on the roof, and smeared the neon and headlights outside the windows. A cheap radio was playing elevator music.

The loaned gun was a hard, cold lump tucked under his belt, hidden by his jacket. He took a deep breath. Time to do it.

Grabbing a bag of chips, John went over to the counter. The old guy looked at him like he wasn't there, and said, "Seventy-five cents."

John looked around wildly, then yanked out the gun and aimed it at the old guy. It was heavy; he couldn't hold it steady. "Give me all the bills in the register!" he yelled. "Don't forget the big ones under the tray!"

The old guy's face twisted in fear. Sweat made his bald head glisten. "You go away, or I call police!" he shrilled. "You go away!"

This wasn't how it was supposed to go down. A gun was supposed to make people do what you told them. "Give me the money, or I'll blow you away!"

A scrawny arm dove below the counter. John figured it was reaching for an alarm button, and got ready to run. But it came back up holding a baseball bat. Screaming something, the old guy swung at John's head.

John didn't have time to think. He reacted. He jerked the trigger.

The slug punched a small round hole in the old guy's forehead, and blew the back of his head off. Bottles shattered on the shelves behind the counter. The bat slipped out of the dead hand, and the old guy sagged to the floor. Blood, brains, and booze dripped down the shelves. Gut-sick, John leaned against the counter and puked—

John woke up.

He was sprawled on his back, shaking and gasping for breath. Cold sweat covered his body. The sheet had become a soaked, twisted lump at the foot of his bunk. The cell was night-dark except for the faint walkway light filtering through the bars. Weber's snores came from the shadowy shape of the upper bunk.

Fourteen months into his time at Q for murder two, and John still hadn't been able to shake the nightmares. At least he hadn't screamed this time. Any sign of weakness made you prey.

A guard's boots clanged on the walkway grating; snores and coughing came from other cells. The air stank with rage, fear, too many caged men. Even in the middle of the night the tension in the cell block tried to choke him.

He fought to calm down, to get control. Control meant survival in the belly of the beast. And he was going to survive. He was going to walk out on his feet, back into the world.

His breathing slowed, and the shakes went away. He used the sheet to wipe off his sweat. Then he pulled it over him, and tried to get back to sleep.

Dark, sullen clouds hung over the yard, cutting it off from the afternoon sun. A chill wind kicked leaves across the grass and dirt. Guards on the wall stared down at the sixty or so cons walk-

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ing, talking, and playing football.

John wandered aimlessly around the yard, carefully avoiding gang turf. Going solo wasn't easy, but he had had his fill of colors. He was showing his con face. Nobody hassled him.

He missed having friends to hang with, but he couldn't ever let his guard down. So he thought a lot, usually about things he would do when he got out, or just let his mind drift.

"Hey, Grace!"

John turned slowly. A pair of guards, one carrying a shotgun, stood behind the fence gate.

"Yeah, you!" Shotgun yelled again. "Come here!"

John strolled over. He felt the other cons staring at him, wondering the same thing he was. What did the guards want with him? He hadn't made any trouble he could think of, but that didn't mean much.

The guards cleared him through the gate, and cuffed him. He knew better than to ask what was going down. They marched him across the compound and into the admin building. The citizens looking at him like he was some kind of animal gave him a pain, but he didn't let them see it.

He really started to worry when he saw that the guards were taking him up to the warden.

The warden's office was big and full of fancy furniture, and it seemed gloomy to John after being outside. It was crowded, too. The warden was at his desk, with two strange suits filling chairs on either side. A pair of cuffed cons stood facing the desk. John knew them by rep: Gomez, connected with La Raza, and Mangarian, a freak in for rape. Two guards by the door were keeping a close eye on them. Shotgun's partner shoved John over beside Gomez, then joined the guards by the door. Shotgun left.

The warden frowned at each con, John last. "Now that Mister Grace has joined us, we can begin."

He gestured to the pair of suits. "These gentlemen are Doctor Carter and Mister Lee. They are here looking for volunteers for an important scientific experiment."

"What's in it for me?" Gomez demanded.

"The parole board will be informed of your contribution to the public welfare. It'll be a significant factor at your next hearing. Beyond that, no promises."

At a nod from the warden, Doctor Carter stood up. He looked nervous, and his voice was wound tight. "We, ah, have developed what you might call a teaching machine. It electronically records information in the brain."

"Like taping a show on a VCR?" Mangarian giggled.

Doctor Carter winced, then his nervous smile returned. "Somewhat. I won't, ah, bore you with the technical details. But I'm sure you can see what a major advance this is. People will be able to learn anything, no matter how difficult, in a matter of minutes."

Gomez looked suspicious. "You want to shoot electricity into my head, like they do psychos?"

"It's nothing like electro-shock therapy, I assure you. The amount of current is less than that generated by a flashlight battery. Theoretically there shouldn't be any danger of brain dam-

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age. The machine has been tested on mice and monkeys and they came through in perfect health."

"If it's so safe, why are you here?"

Doctor Carter paused. "Unfortunately, because this is a new technology, there's a slight but unavoidable, ah, element of risk. So we thought it best to look for, ah, strongly motivated volunteers."

"The test involves teaching you a job skill." Mister Lee spoke for the first time. "You might find that useful after you're released."

"Are there any further questions?" Doctor Carter asked.

Nobody said anything.

"That's the deal, then." The warden took over, as Doctor Carter sat down. "Who wants in?"

John didn't have to think about it. He would have done almost anything to shave even a day off of his time. As for the "slight risk" of getting killed, that was a way out, too. "I'm in," he muttered.

Gomez and Mangarian also volunteered.

The examining room was part of the prison hospital. It didn't have any windows, but bright fluorescent light made its white plastic and polished metal glisten. It smelled faintly of alcohol. Instead of medical equipment, the tables and shelves were covered with electronic gear. Consoles hummed and displays glowed colorfully. The two guards who had brought and uncuffed John were leaning against the wall, watching him closely.

Mister Lee kept tinkering with the electronic gear, but Doctor Carter came over to John and shook his hand. "Welcome. Your assistance in this, ah, test is very much appreciated. You aren't nervous, are you?"

John was scared spitless, but he wasn't about to admit it. "I'm OK. Let's get to it."

"Fair enough. First there's the matter of, ah, which job skill to teach you. We have three tapes—automobile repair, restaurant cooking, and accounting. Which one would you, ah, prefer?"

Knowing how to fix cars could come in handy. "Auto repair."

"Did you get that, Bill?" Doctor Carter asked Mister Lee.

"I'm loading it now."

Doctor Carter led John over to the examining table in the middle of the room. "Please lie down on your back."

John jumped onto the table and stretched out. Mister Lee handed Doctor Carter a weird-looking helmet connected by a cable to the electronic gear. Doctor Carter fitted it tightly over John's head. "Is that uncomfortable?" he asked.

"No problem," John muttered.

"Excellent. All you have to do is relax. It shouldn't, ah, hurt a bit—you won't even know it's happening." Doctor Carter joined Mister Lee in front of the biggest console.

Blink.

Nothing seemed to happen. John felt normal. Wondering when they would get started, he stared at the white ceiling. He noticed that his hands were fists; he made them lie flat.

The examining table began to tremble, and the overhead fluorescent fixtures swayed. At first John thought it was part of the test. Then, as it got

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worse fast, he realized that it was a quake.

He hated quakes. There weren't many things you could count on, but solid ground should have been one of them. It wasn't *right* for the world to shake around you.

John waited, second after agonizing second, for the quake to peak. But it didn't. Tools, small piece of equipment fell from the shelves and tables. The walls and ceiling groaned, over a hollow rumbling that seemed to come from all around.

"Get under cover!" Doctor Carter yelled. The guards, looking as scared as John felt, wrestled the door open and tried to push through at the same time. Doctor Carter and Mister Lee scrambled under the electronic gear tables. John yanked off the helmet, then rolled off and under the examining table.

It was the worst quake John had ever been in. He was actually bouncing off the linoleum. Fixtures fell and fluorescent tubes exploded. Cabinets tipped over, their contents raining out. Something incredibly loud happened to the suits' side of the room. It disappeared behind a thick gray dust cloud that spit out chunks of plaster and concrete.

John squeezed his eyes shut and covered his ears. Maybe he screamed, but he couldn't tell. He knew for sure that he was going to die.

But he didn't. The quake finally peaked, then started to subside. When everything stopped moving, he crawled out from under the examining table.

The eerie silence was punctured by distant screams. Daylight came into the room through a ragged gap where a corner had been, becoming a dim haze in the swirling dust. The floor was an uneven terrain of rubble. The walls were cracked and weirdly twisted.

Doctor Carter and Mister Lee were buried under a slab of ceiling concrete that must have weighed tons. One of the guards was out cold by the door. The other must have gotten away.

John peered outside through the gap. Cell Block C was on fire; guards were herding cons into the yard. A fire engine roared around the corner of the admin building, siren blaring. A wide crack crossed the lawn, and the wall was down in at least three places. The power was out everywhere he could see. Distant columns of black smoke rose into the sky.

No guards nearby! The wall down! He could just walk out!

John hurried over to the unconscious guard and grabbed his gun. But as John straightened, the guard's eyes opened. He saw the gun in John's hand, and turned pale. Panicking, he scrambled toward the door.

John couldn't let him get away. He would fetch other guards, and stop the break before it started. "Freeze, man, or I'll blow you away!" John yelled hoarsely.

The guard kept going. He was in the doorway.

John aimed at his head, started to squeeze the trigger.

The slug punched a small round hole in the old guy's forehead, and blew the back of his head off. Blood and brains dripped down the shelves—

Gut-sick, John threw the gun away. The guard disappeared down the corridor. Swearing wildly at his own weakness, John ran over to the gap and

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through it.

He hurdled the crack in the lawn, and headed for the nearest collapsed wall. Smoke from the fire choked him. An aftershock almost knocked him down. Blood was leaking from some small cuts on his arms. He expected alarms, pursuit, slugs punching through him.

But he didn't stop running, and nothing stopped him.

Not much traffic in the street. Small shops, some boarded shut, and walk-ups. Kids playing in an empty lot, men hanging in front of a liquor store, a bum sleeping in a doorway. A stink from the rotting garbage on the sidewalk.

It wasn't home—John couldn't show his face there—but it was his kind of street. The man was the enemy here; nobody would sell him. He was as safe as he was going to get.

He was tired and sore from walking. And hungry and thirsty. And cold, since he had trashed his prison shirt to pass as a citizen. He looked around for a chance to boost what he needed.

The big open entrance caught John's attention. Looking up, he saw a sign with most of its neon burned out reading MAC'S GARAGE.

He remembered the teaching machine test for the first time since his break, and a weird thing happened. He realized that he knew how to fix cars! The techniques, the tools, the terminology: it was like he had always known them.

A job? Well, he needed money, and boosting it would increase his risk of ending up back in Q. Why the hell not?

He walked into the dimly lit garage. There was enough floor space to work on two cars, a rack, and a small office in back. The tools were old, the parts shelves sparsely stocked. Gas cut through the street smell. But the place was in better shape than he would have expected: oil stains cleaned up, equipment in good repair, shelves neatly stacked.

An old guy in patched coveralls straightened from under the hood of a Chevy pickup. He was tall and trim, and stood straight like he had been in the military. His head was bald except for a fringe of black hair. Staring sourly at John, he demanded, "What do you want?"

People with attitudes gave John a pain. "I'm looking for a job," he muttered sullenly.

"I don't need any unskilled labor."

"I'm a mechanic."

"That so? Where did you train? Got a resume to show me?"

The anger that John knew too well returned. His hands became fists, and he took a step forward. Then he remembered the other old guy. This one wasn't worth it.

Getting most of his control back, John snapped, "I bet I know my way around a car better than you! So who needs this dump! I can do better!" He spat on the concrete in front of the old guy, and headed for the entrance.

"That's it, turn tail and run, you gutless wonder!" the old guy yelled.

John almost lost it. He was in the old guy's face, fist raised, before he could stop himself. "What the hell do you mean by that?!"

The old guy didn't look afraid. "All your life people have made you feel that you're inferior. Even those who helped you thought you needed help. You ex-

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pect to fail, and you hate it, so you give yourself an excuse going in. If you've got the guts to really try for a job here, start over. Otherwise, you were going the right direction." With that the old guy walked back to the pickup.

John wasn't afraid of anything. He would show the old guy the best piece of kiss-ass job applying ever. Then, when the old guy shined him on, he would be righteously pissed and stomp that bald head.

John went over to the pickup. "Excuse me, sir?" he said super-politely.

The old guy straightened. "What do you want?" he demanded sourly.

"My name is, uh, Jesse Williams." John came up with the alias just in time. "I'm looking for a job as a mechanic."

The old guy wiped his hand and put it out. "I'm Anse MacDonald—folks call me Mac. This is my place."

John shook the hand. "Pleased to meet you," he said through gritted teeth.

"Got a resume?" Mac asked.

"I taught myself, and I haven't worked anywhere."

"Why should I hire you?"

John had to think about that one. "Because I can do the job, and do it cheaper than some guy with a fancy paper."

Mac stared at him for a few seconds. Then he patted the hood of the pickup. "There are three things wrong with this engine. Find them, and the job is yours."

So Mac thought he was all mouth. Well, he would show the old guy something. Grabbing a screwdriver and a socket wrench, he leaned over the densely packed mass of machinery.

A lot of time and work later he finished. Wiping oil and sweat from his hands and face, he turned to Mac. "You missed one," he said smugly.

"Do tell."

"The timing is off, the fuel pump is shot, you've got a cracked manifold, and the carburetor needs adjusting."

Mac nodded. "Car repair lesson number one—don't believe everything you're told, check it. Lesson number two—don't get cocky. The thermostat is out, too."

John swore to himself. He had missed that.

Mac's face seemed to crack as he grinned. "But four out of five isn't bad for a young pup. You're hired."

John made sure he had his con face on, so Mac wouldn't see how good he felt.

It was John's first job. For the first time he had real money in his pocket. Not the big money he had always dreamed of, but enough to get by and then some. A furnished apartment in a building without any crack dens. Some nice clothes. The '75 El Dorado that Mac was letting him fix up in the garage after hours. Restaurant meals and a social life.

Respect was a word he and his pals used to throw around a lot, but now he was finding out what it really meant. Folks whose cars he had fixed said hello to him on the street. Shop clerks who used to check him out for boosted stuff now gave him polite service. Janice over at Doug's Barbeque seemed to find his steady job more impressive than his style. But the best thing was how he felt about himself when his rebuilt engines,

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brake jobs, and transmission work met Mac's tough standards.

John couldn't figure Mac out. The old guy was sour, preachy, and an all-around pain in the ass. Mac never cut him an inch of slack. But Mac never looked at him like he wasn't worth seeing. Mac taught him a lot about car repairing that the machine had missed, and gradually trusted him with harder and harder work. John decided he could have done a lot worse for a boss.

He could have done a lot worse, period.

John was under a '57 T-Bird, taking a wrench to a mounting bolt. It wouldn't give, and his position kept him from putting much muscle into it. Sweat dripped from his face.

The garage was night-quiet except for occasional cars in the street and a dog barking. Mac had gone home at closing time. John should have bagged it too, but he had been trying to track down an oil leak since lunch. He was getting nowhere fast, except pissed.

The wrench slipped in his greasy hand, and he skinned two knuckles. Swearing violently, he threw the wrench away and sucked his bleeding fingers.

Damned antique Detroit iron! John was sore, tired, and sick of kissing automotive ass when he should have been getting it on with Janice. He felt like running the T-Bird through a wrecker's compacter, or sticking a match in its gas tank. That would fix the oil leak!

Footsteps caught his attention. Turning his head, he saw two pairs of legs entering the garage. He rolled out from under the T-Bird and stood up, wiping his face and hands.

Two guys his age. One in a slick white suit, smiling to show off his gold tooth; the other a big smashmouth type. John stared for a moment, then grinned through his surprise. Willie and Ice? What were his two pals from the old neighborhood doing here?

"Yo, John!" Willie gave him a high five. "Been awhile. How's it going?"

"OK, I guess. The name is Jesse now."

"Like that, huh? Heard you busted out of Q."

"What brings you around?" John asked cheerfully. It felt good to hang with his pals again, like in the old days.

"We've got a big deal going down," Ice growled. "Somebody said you were working here, so we came over to see if you want in."

"What kind of deal?"

"Three pounds of snow. Pure stuff—we can step heavy on it. All we need is some seed money."

Visions of the things a really fat wallet could do for him strobed in front of John's eyes. No more hard, dirty slave-work. He could be a gentleman of leisure.

"You can do better," Willie said, looking around the garage. "Time to ditch this dump and move up."

"There's over a thou in the safe." John felt strange, excited and gut-sick at the same time. "A lot of our customers aren't the sort you take checks from."

Willie licked his lips. Nodding, Ice said, "Get it. The deal goes down tonight."

John walked down to the office like he was on his way to the gas chamber. Moving the desk and rug, he knelt over the floor safe. Mac had given him the combination after his first cash cus-

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tomer, and hadn't made anything of it.

His hand froze over the dial. He had seen what he would be getting; now he saw what it would cost. What he would lose, after just discovering. Would he be coming out ahead?

No way!

John stood up, put the rug and desk back, and walked out to Willie and Ice.

"Where's the money?" Willie asked eagerly.

"Forget it."

"Huh?"

"I changed my mind. Count me out."

"You can't mean it!" Willie looked shocked. "The whole world is out there, just waiting for you to take what you want! Don't be a sucker!"

Ice took a menacing step forward. "Don't even think about trying to cut us out!"

John grabbed a mallet from a toolbox. He wouldn't feel bad about cracking a couple of skulls in self-defense. "See you around," he said grimly.

The pair stared angrily at him for a few seconds. Then Willie grabbed Ice's arm. "Come on. Forget this loser." They turned and left the garage.

John watched them go, feeling lost and stupid. He banged the mallet back in the toolbox. Then he retrieved the wrench from where he had thrown it, and rolled back under the T-Bird.

Blink.

John was lying on the examining table, staring up at the white ceiling. It seemed like he had been there awhile. The teaching machine must have made him black out. He had a strange feeling that he should have been somewhere else, but it faded quickly.

Doctor Carter loomed over him. "Are you experiencing any pain or, ah, disorientation?" the suit asked.

"I'm OK, except for a sore butt."

"Excellent." Doctor Carter helped John sit up, then he removed the weird looking helmet. "The telemetry also indicates that you came through in perfect health."

After putting the helmet on a shelf, Doctor Carter turned back to John. "Do you, ah, understand automotive engineering now?" he asked eagerly.

The question was like turning on a light inside John's head. He realized that he knew how to fix cars! The techniques, the tools, the terminology: it was like he had always known them. "Yeah, your machine worked."

"Excellent!" Doctor Carter enthused. Mister Lee, who was still tinkering with the electronic gear, turned and grinned.

"Now what?" John asked.

Doctor Carter gestured to a table with some papers and pencils on it, and two chairs. "If you're, ah, up to it, I would like to give you an aptitude test to measure memory retention and comprehension. Then we'll proceed to the shop for, ah, a hands-on evaluation—we have some automobiles for you to repair."

"No problem," John muttered. He had always hated taking tests in school, but he had a surprising itch to see what he could do with a broken down car.

He jumped down from the examining table. "Let's get to it."

The warden's office was dark except for a pool of light around the big desk. The warden was working late at his computer terminal, alternately typing and frowning at the results on the

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screen. Stars and a full moon shone beyond the window.

The intercom buzzed. Touching a button, the warden said, "Yes, Elizabeth?"

"Doctor Carter to see you."

"Thanks. Send him in."

The warden met Doctor Carter at the door, shook his hand, led him to a chair beside the desk, then sat down. "How did it go?" he asked.

"Very well indeed." Doctor Carter slid three tape cassettes across the desktop to the Warden. "Our preliminary reports on the test subjects."

The Warden put them in a locked drawer. "Do any of them suspect that the test wasn't what it seemed?"

"That it was, ah, more than it seemed, you mean. None of them have any memory of the interactive scenario phase."

"That's a relief. The 'teaching machine' con comes very close to prisoner abuse."

Doctor Carter nodded. "I'm not too comfortable with it myself. But it's for the, ah, test subjects' own good. Knowledge of the test's, ah, true purpose could set up a hostility block which would inhibit receptivity."

"If you say so. Did you come up with any candidates, or are you going to need another batch of prisoners?"

"One excellent candidate. John Grace."

The warden frowned. "Grace? He blew an old man's head off in a grocery store stickup. He'd seem to be a lousy choice for salvation."

"He experienced a profound empathic reaction to that episode. His responses to the interactive scenarios were positive. Admittedly his, ah, hostility index is high, and his superego functions are primitive. But with proper, ah, counselling an acceptable degree of socialization is likely."

The warden was quiet, thoughtful for several seconds. Then he said, "I'll endorse your recommendation for an ER parole for Grace."

"Thank you." It was Doctor Carter's turn to pause. "Your cooperation in what is admittedly a novel approach to rehabilitation is, ah, most helpful. I'll be sure to mention it in my report to the governor."

The warden went over to the window, and stared down at the floodlit compound. It was empty and still except for the patrolling guards. "One thing I've learned in seventeen years of penology," he said softly, "is that we can't rehabilitate prisoners. But some of them can rehabilitate themselves, if they want to badly enough. Those we can help make it. I've often wished for a touchstone to pick them out from the career criminals. Thanks for inventing it."

"In the long run this use of the technology might, ah, prove as important as the educational function."

"What about the other two prisoners?" the Warden asked. "Gomez and Mangarian?"

Doctor Carter shuddered. "Psychiatry likes to believe that, ah, everybody can be helped. But if I were you, I would throw the keys to their cells away."

"You should meet some of our hard cases," the Warden replied. "But one out of three isn't bad."

He sensed more than saw the cell blocks brooding in the darkness. "Not bad at all." ■

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brass tacks

Dear Dr. Schmidt,

I am writing to you about "Defect?" in the June 1991 issue. I happen to have Turner's Syndrome. Also, I am a member of the Executive Board of the Turner's Syndrome Society of the United States.

I enjoyed the story, especially the explanation of the chromosome defect using french fries. However, in the story a comment was made, "growth hormones cause problems later on in Turner's patients." Recent studies suggest that *this is not necessarily true!*

There are many little girls with Turner's Syndrome that are currently taking growth hormones and their parents probably would be very concerned if they read this. The doctors who happen to read this might get the wrong idea which could ultimately influence their treatment recommendation if and when they see a Turner's girl.

B.M. FLINK

New Britain, PA

The author replies . . .

Ms. Flink is right to be concerned about the negative blanket statement in my story and I have to apologize to her. I failed to notice that a few critical words in the original manuscript were missing in the galleys. The sentence that she refers to originally read (missing words in parenthesis): ". . . since (early) growth hormones (sometimes) cause(d) problems . . ." This is a substantial difference. My literature review does support the original statement, as my character would only have had such available when a baby. But this is a very different matter than the synthetic growth hormones presently being used.

Again, I want to apologize if I have indirectly worried any Turner's parents.

F. ALEXANDER BREJCHA

Dear Dr. Schmidt

As a Christian Scientist, I must comment on some of the conclusions F. Brejcha draws from the trauma experienced as a little child by James Gabriel in "Defect?"

F. Brejcha has done a lot of research on Turner's Syndrome but an unequal lack of research on Christian Science, which shows through in the story. Brejcha states that James's father was a "minister." We have elected lay readers who serve three-year terms conducting church services but we have no ordained clergy or ministers. James Gabriel is portrayed as a "Luddite" who opposes technical progress. There is nothing in our church teachings that supports opposition to scientific progress in any field and indeed much that causes us to support technological progress (for obvious reasons, we don't comment on medical research, but we do not oppose it). James Gabriel's behavior in leading the demonstration as described in the story is very uncharacteristic behavior for a Christian Scientist, and would be against the rules of our church bylaws if the target was medical as occurs in *Defect?*

The danger of just naming Christian Science as the cause of James's trauma without exploring some of the issues that make Christian Science different

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begs the issues, and is a form of name calling which automatically invokes some current stereotypes. The public is led to believe by recent publicity and court cases that just because we don't provide conventionally accepted medical care for our children that we are "child abusers" and therefore don't love their children. How many "nonconventional" ideas have been discarded or ridiculed by the majority because they were different? Brejcha has capitalized on a label by assuming that people should draw the conclusion that Christian Science does not work. Would F. Brejcha have had the basis for a story if the background event had been about a medical doctor who lost a child while using an experimental, unproven means of treatment?

DAVID NEWBERN
10032 Park Woods Lane
Burke, VA 22015

The author replies . . .

Gabriel's father was not a minister in the ordained sense, but in the personal and spiritual sense. I did speak to some Christian Scientists before writing the story, but obviously I was not sufficiently clear on this point. I was so intent on delineating the etiology for Gabriel's overly zealous behavior that I lost sight of what to me was not the main point, but which actually was important.

F. ALEXANDER BREJCHA

Dear Mr. Schmidt,

Although I am a Catholic, I must protest the insulting, absolutely unfair and ridiculous references to Christian Science in "Defect?" by F. Alexander Brejcha. If he can actually tell me of a case where such a protest occurred, I will stand corrected. But I have lived in many American cities, all of which had Christian Scientists, and never once have I seen the slightest indication that any of them were not perfectly willing to let us have any kind of medical care we wanted. Nor do I know of any case where they have tried to prevent others from getting, or working on, medical care and research. Nor are they the kind of people who go around shouting "abomination" at people who simply happen to look a little different, particularly when the difference is no more than a matter of height. Of all the totally far-fetched excuses for villains, this has to be it.

Who will be next? Maybe the Amish, seen as dastardly conspirators bent on depriving us of our VCRs and laptop computers.

All that Christian Scientists ask is not to have medical care forced upon them when they don't want it. You may well hope that they could be convinced to allow it for children, until they are old enough to decide for themselves; but if it isn't a matter of convincing them, if it becomes a matter of "we'll make you do this because *we are right and we know you are wrong*"—then who is being self-righteous?

MARGARET HOWES

The author replies . . .

After reading your letter I have to say that I would have agreed with everything you said—if you had been reading the story that I wrote.

I ask you to please read "Defect?" again, a bit more carefully. It was intended as an affirmation of the beauty and worth of women who can't meet the ridiculously impossible media ideals Madison Avenue blasts them with (just as I dealt with weight in "I'll Show You Mine If . . ." a couple of months ago). It was not meant as, and actually is not, a direct attack on the Christian Science church, as much as I take issue with it. Working at a hospital, I have seen

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firsthand the sufferings it can impose. But that is, as you rightfully pointed out, their choice. My only real point of contention with their belief is what it does to children who have not made that choice. The death of the Twitchell child in Boston is only the latest and most public example of that. Regrettably, there are other similar groups. Here in Philadelphia, several children died of measles because their parents refused to have their children immunized or hospitalized. They were of the State Tabernacle faith. So the Christian Scientists are not alone in being against medicine.

Next, if you read the story more carefully you'll also see that Gabriel is not the raving lunatic you perceived. Speaking privately to Barbara, he admits very openly that he is putting on an act to motivate the crowd. He uses Barbara's difference and role as mere tools for egging the crowd on. He took a group of—faith unspecified—people and used mob psychology to lead them in an attack that he felt was justified. Personally, he is a Christian Scientist who is acting very logically according to well-documented coping mechanisms to deal with a personal problem. His state of mind is further aggravated by the extreme conditioning his traumatized father imposed on Gabriel out of guilt due to the death of Gabriel's brother. Scientifically and psychologically, I stand by the behaviors of all my characters. I feel for Gabriel very strongly. I have seen people in his position. He is a man who is very troubled—not evil or a "villain" as you called him.

F. ALEXANDER BREJCHA

Dear Dr. Schmidt,

I have written in the past when I felt a story was particularly bad, so balance requires that I write when I am particularly impressed by a story.

The July 1991 issue was full of excellent work. Every story and article was interesting and entertaining. I have enjoyed Lois McMaster Bujold's Miles Vorkosigan stories, and very much enjoyed the first part of *Barrayar*. Hers is a well wrought universe with real people inhabiting it. I look forward to the rest of the story.

As good as the other stories were, the best was Dean McLaughlin's "Ode to Joy." I can't remember when I last read a science fiction story that seemed so right. On every level, this story epitomized what a science fiction story should be. I've always enjoyed his work but this story puts him among the top rank SF writers. I look forward to seeing his name among the nominees for the Nebula and Hugo awards.

DAN THOMPSON

Huntsville, AL

Dear Dr. Schmidt,

After reading the Brass Tacks section of the July, 1991 issue, I decided not to wait until I was compelled by some indignation to write my first letter to you. Then I read "Ode to Joy" by Dean McLaughlin, and was further motivated to write immediately.

What more could I ask? I learned some new things, lived in a totally unfamiliar environment for a short time, and wept with the joy of wonder of being human all from one story? I walked the corridors of those labs and knew the workers there on sight and by reputation. It made my day and I appreciate again the presence of *Analog* on my reading table.

I always enjoy your editorials; they're provocative and I often use your arguments to bolster some of my own.

Over all, thanks for providing such quality entertainment. I hope you never

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change your style.

DELPHINE DE MORE

Encino, CA

Dear Mr. Schmidt:

Dunno when I started reading *Astounding*, about 1941 I guess. Later I got bored with Venus Equilateral; there's more to life than gadgeteering. But I remembered particular stories. While I remembered "He Built A Crooked House" and retold it to my friends, I did not realize until I read your 50th anniversary collection that it had been written by one of the masters, Heinlein. And there were other SF writers who, without gracing your pages, wrote real novels with believable characters: H. G. Wells for one. As a person with degrees in both literature and engineering, I enjoy the new style of SF that has both scientific imagination and believable (or, sometimes, unbelievable but interesting) characters.

In reading "Ode To Joy" in the July issue I noticed that the protagonist, the director of research who employs the genius, had the unusual but familiar name of Mr. Norway. Could it be that the author gave his character that name with deliberate intent? Then Mr. Norway writes his initials on a film badge: N. S. N. The evidence was complete. Nevil S. Norway, the author of *Slide Rule: The Autobiography of an Engineer*, assistance performance calculator for Geoffrey de Havilland, assistant chief engineer of one of the few successful rigid airships not built and operated by Zeppelin, founder and president of a medium-sized aircraft manufacturer, and novelist whose books included SF.

The story of "Ode to Joy" convinces me that Dean McLaughlin meant his novella in part as a tribute to one whose memory deserves it. The story line and characters, while new, reflect the works of Mr. Norway. There's the research director from *No Highway*, the unfathomable presence of genius, the factory hands, technicians and engineers from *Trustee From The Tool Room*, the love of machines finely crafted from scientific knowledge, engineering skill, and machinists' crafts that permeates Norway's books and endures until the final scenes from *On The Beach*. You know him now, for Nevil S. Norway published under his middle name of Nevil Shute. For how many other readers did this tribute give added meaning to "Ode to Joy?"

JOHN FORESTER

Sunnyvale, CA

The author replies . . .

Once, long ago and very briefly, I also met the gentleman best known as Nevil Shute, and was much impressed with his modesty and fundamental sense of decency. At the time I had read none of his work, an omission I've since corrected to my lasting benefit.

Tribute may be too strong a term, though might be considered apt. Early in the writing of what became "Ode to Joy," I realized I had chosen the mode of storytelling he was himself most comfortable with, i.e. a first person narrator who is a secondary participant in the events described. "All of which I saw, part of which I was." Further, most if not all of my characters, like his, possessed the "plain man's" essential decency, which I believe must have derived from the man himself. All of this, consciously recognized, helped tremendously to illuminate and shape my story into its completed form.

The least I could do was add his fingerprint.

DEAN MCLAUGHLIN ■

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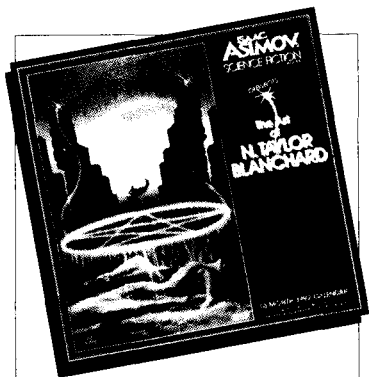

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a calendar of analog upcoming events

24-26 January
BASH '92 (Boston-area Star Trek™ convention) at the Sheraton Tara, Braintree, Mass. Guest of Honor—Colm Meaney. Registration—$35 ($20/day) until 1 November 1991; $40 ($25/day) thereafter and at the door. Info: Bash Conventions, % Boston Star Trek Association, Inc., Box 1108, Boston MA 02103-1108. Include SASE. (617) 894-BSTA.

7-9 February
TRINCON 400 (Irish SF convention) at Trinity College and Powers Hotel, Dublin, Ireland. Sponsored by Dublin University SF Society in honour of Trinity College's 400th anniversary. Guest include John Brunner, Ramsey Campbell, Diane Duane, Anne McCaffrey, Peter Morwood, Terry Prachett, Bob Shaw, etc. IR£5 supporting, IR£10 until 1 December 1991, IR£15 thereafter. IR£7 per day at the door. Info: The Secretary, TrinCon 400, 75 Kincora Ave., Clontarf, Dublin 3, Ireland. Phone: 353 1 7021827 Fax: 351 1 778996. email: sfsoc@maths.tcd.ie%pucc.princeton.edu.

7-9 February
PSURREALCON '92 (Oklahoma SF conference) at Central Plaza Hotel, Oklahoma City, Okla. Guest of Honor—Tad Williams, TM—Robin Bailey, Artist Guest of Honor—Bill Hodgson, Fan Guest of Honor—Casey Hamilton. Registration—$15 until 1 February, $18 at the door. Info: PsurrealCon, Box 2069, Norman OK 73070-2069. (include SASE)

14-16 February
BOSKONE 29 (New England area SF conference) at the Sheraton Monarch Place & Springfield Marriott Hotels, Springfield, Mass. Theme—"The Art and Practice of Storytelling." Guest of Honor—Jane Yolen, Official Artist—Jody Lee, Special Guest—Dave Langford. Registration—$29 in advance, $40 at the door. Info: Boskone 29, Box G, MIT Branch PO, Cambridge MA 02139-0910.

17-20 April
DISCONTINUITY (Aukland SF convention) at Allenby Park Motor Lodge, Papatoetoe, Auckland, New Zealand. Guest of Honour—Terry Prachett, International Fan Guest of Honour—Maureen Thomas, Local Fan Guest of Honour—Peter Hassell. Held in conjuction with Rolecon '92—the New Zealand national role-playing competition. Registration—$NZ20 supporting, $NZ40 attending. Info: Post Office Box 74013, Market Road, Auckland, New Zealand.

3-7 September
MAGICON (50th World Science Fiction Convention) at Orange County Civic & Convention Center, Orlando, Fla. Guest of Honor—Jack Vance; Artist Guest of Honor—Vincent Di Fate; Fan Guest of Honor—Walter A. Willis. Registration—$85 adult/$35 child until 30 September 1991. Supporting—$25. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: MagiCon, Box 621992, Orlando FL 32862-1992. (407) 275-0027. UK agent Peter Weston, 72 Beeches Drive, Erdington, Birmingham B24 ODT UK.

29 October-1 November
WORLD FANTASY CONVENTION at Callaway Gardens, Pine Mountain, Ga. Limited membership. Registration—$100 in advance. Info: World Fantasy Convention 92, Box 148, Clarkston GA 30021. (include SASE)

—Anthony Lewis

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SPACE AGE SPEAKER

Imagine being able to listen to music anywhere in your home or even outdoors without having to run miles of speaker wire. You could if you had the amazing new WS7 Wireless System from Datawave.

Datawave's breakthrough design is a patented FM technology which broadcasts music wirelessly from a small transmitter to satellite speakers. The transmitter, about the size of a paperback book, broadcasts music from virtually any sound source to a receiver built into the speaker. (The transmitter taps into your stereo's signal through a simple connection to any audio output or headphone jack.)

You could listen to any component of your stereo system (CD's, records, tapes, AM/FM stereo, etc.) and enjoy deep, rich bass and crystal clear highs. The bookshelf sized, 8.5 x 4.5 x 4.5 inch cabinet, with its full range 4 inch driver mounted at the top, provides a 360 degree surround sound pattern. In addition, the speakers operate on two selectable frequencies, insuring you static-free transmission.

These speakers are self-powered, with 150 foot range through walls, providing total coverage in every home. And because the speakers have their own built-in amplifier, you can control the volume and power independently at each speaker. Best of all, they can *never* be blown out.

The WS7 operates on an AC adaptor or 4 C-batteries, which will power the speakers for about three months. The speakers even have a built-in detection circuit which automatically cuts off the speakers when you turn off your stereo.

You can operate as many speakers as you like on one transmitter. Broadcast both left and right channels to utilize one speaker in a room, or use two transmitters with two speakers to get full stereo separation.

Try these speakers **risk free** for 30 days and if they're not everything we say they are, return them for a full refund, including S&H charges. Plus, these speakers carry a full 90-day manufacturer's warranty.

- **Speaker & transmitter ...$99 ($6 S&H)**
- **Additional speakers ...$69 ea. ($6 S&H)**

Please mention promotional code **AS1102**.

Call toll free 800-992-2966

To order by mail, send check or money order for total purchase (Va. residents add 4.5% sales tax), or enclose credit card # and exp. date along with name, address, and phone number to:

Comtrad
11600 Busy Street, Building 103
Richmond, VA 23236

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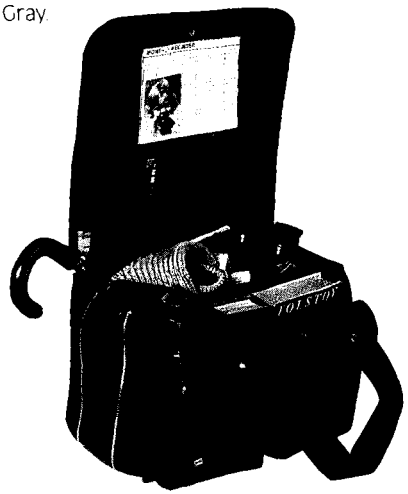
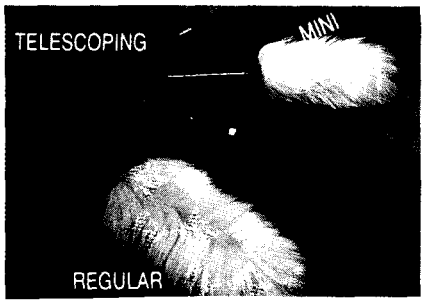
MAIL ★ ORDER ★ MALL

▼ EVERYTHING BAG

People on the go always have so much to carry around. The Everything Bag makes it a snap. This oversized shoulder bag is constructed of tough, water-resistant canvas material and features nine roomy pockets. Plus, an unusual zipper design enables the bag to expand to double its normal width—to a full eight inches. Adjustable 2" wide straps provides a real comfort feature. In 3 great colors. **$24.98** ($4.00) #A1955-Blue; #A1956-Khaki; #A1957-Gray.



▼ LAMBSWOOL DUSTERS



Lambswool contains a natural static charge that makes dust literally leap off surfaces. Our dusters are imported from England. They are the fluffiest, highest quality lambswool in the world! We offer a set of four lambswool dusters: our 27" duster, our telescoping duster which extends to more than four feet—lets you reach high corners, top shelves, overhead lights and collapses to 28", and two mini dusters. **$22.98** ($4.00) #A1870.

▼ TALKING ALARM CLOCK

Tired of waking up to an annoying buzz? Why not awake to a crowing rooster and time report! Our battery operated talking alarm clock announces the hour and gives the time with the push of a button. Sleek design in white with LCD readout. Takes 4 "AA" batteries (not included). 5½"x 3"x4". **$27.98** ($4.50) #A1916.

TO ORDER: Send check with item number for total amounts, plus shipping & handling shown in ( ) payable to **MAIL ORDER MALL**, Dept. 022 AN, P.O. Box 3006, Lakewood, N.J. 08701, or call TOLL FREE **1-800-722-9999.** NJ residents add 6% sales tax. We honor MasterCard/Visa. Sorry, no Canadian, foreign, or C.O.D. orders. Satisfaction Guaranteed. 30 day money back guarantee for exchange or refund. Allow 30 days for delivery.

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